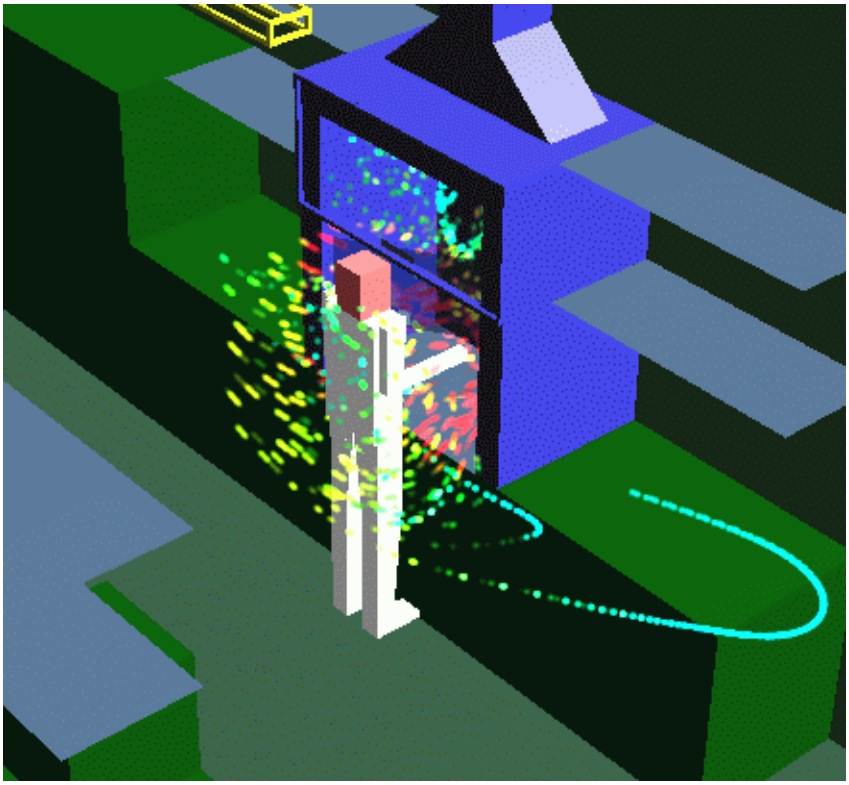
National Institutes of Health

Methodology for
Optimization of Laboratory Hood Containment

VOLUME II SIMULATION

DATABASE



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1. INTRODUCTION

This appendix contains a database of the Computational Fluid Dynamics simulations for these National Institutes of Health Guidelines for Optimization of Laboratory Hood Containment.

It is impossible to present all the data produced by the CFD calculations, even the analysis data presents an enormous quantity of data that would be difficult to present and interpret. Indeed even the summary data from the analysis of the simulations represent around 200,000 items.

Each simulation is documented on a single page entry, the first (upper) part of which documents the details characterizing the laboratory configuration. The second (lower) part identifies selected simulation results from each of the analysis approaches. Each of the entries are explained in the following summaries.

1.1 Simulation configuration

The database contains the following information for describing each simulation.

Casename : The part of the filename to which file extensions are added to form the names of the input and output files.

Date : The date the data were entered, or last modified on the database.

Model : Whether the flow modeled is inside or outside the building.

Flow : Whether the flow is primarily forced convection, natural convection, or mixed.

Application Types : What type of application the simulation represents - building type, room function, and specific equipment, e.g. hood.

Case Description : General description of the simulation.

Parametric Variation : What particular parameters changed for this case ?

Specialist Devices : What special devices were in use ? For example, what were the ventilation diffusers ?

Thermal : Was the temperature variable active ?

Buoyancy : Were gravitational effects accounted for and if so how was buoyancy modeled ?

Radiation : Has radiation been accounted for internally and/or externally?

Comfort Temperature : Has a comfort temperature calculation been undertaken to look at the effect of combining air temperature, radiant temperature, and air speed ?

Concentration : Was the concentration model active with a concentration inside the hood ?

Turbulence : What turbulence model is used?

Special : Indicates any special functionality used in the software beyond the regular menu system.

Dimensionality : The physical and time dimensions used for the case. For example, 3d Steady would indicate that the case was modeled in three dimensions and assumed to be in a steady condition - no time varying boundary conditions.

A-Array Size : The size of the data array required to run the calculation. Allows the user to ensure the have sufficient memory.

Grid Dimensions : The number of calculation cells in each of the three Cartesian directions.

1.2 ANALYSIS RESULTS

The detailed results of CFD calculations provide an enormous quantity of data, which is commonly interpreted visually. This is practical when only a few simulations need to be compared. However, in this project, more than 200 simulations are performed, and so such an approach is not viable. The progress meeting participants identified six different ways of estimating the effect of room air movement on hood performance. These still provide more than 700 pieces of data for each case/simulation. This summary has selected a subset of that data for hood configurations on the long wall for each of the analyses. In general, ratios of differences have been used to allow comparison of simulations with different sash velocities and hood flows. The data used are as follows :

Dalle Valle Ratio : Dalle Valle identified the velocity distribution on the five surfaces of a box extending out from the exhaust (not the plane of the exhaust) for a perfect exhaust. A perfect exhaust, as defined by Dalle Valle is one where the flow into it is developed as a result of the exhaust suction rather than other sources of velocity / momentum in the space. The resulting distribution is non-uniform and depends on the shape of the exhaust. By calculating the difference between the velocity distribution from the laboratory simulations (V_s) and the so-called perfect exhaust velocity distribution (V_{DV}), then normalizing it by dividing the difference by the perfect exhaust velocity, a measure of the disturbance of the hood flow can be achieved. This is repeated for a grid of points on the five surfaces of a 12" box extending from the sash opening into the laboratory and a mean calculated. The sixth face, the sash opening itself is not used. This mean is the Dalle Valle Ratio as used here.

Dalle Valle ratio = mean of $[(V_S - V_{DV}) / V_{DV}]$

The standard deviation and maximum are also calculated.

Performance Index (PI) : An index based on the difference of the velocity from the desired sash set-point. Three terms are included in the index :

the velocity difference
the turbulence intensity
any reverse flows

$$PI = (d^2 + U_s^2 + U_t^2)$$

where d is 1 if the flow is reversed, U_s is $(V - V_{sash})/ V_{sash}$, where V may be the calculated perpendicular velocity or the 3 dimensional air speed.

The mean and maximum values are listed for the hood sash opening and the box for both perpendicular velocity and air speed.

TIME : The time for the air to reach each calculation cell on the hood sash opening from outside the box is computed. The mean, standard deviation, and maximum are listed. For air traveling at 100 feet per minute it would take approximately 0.6 seconds to travel through the box. High values represent an indirect path and therefore circulation.

REVERSE VELOCITY : Reverse flows are detected and listed for the hood sash opening and the box. The maximum reverse velocity is listed with the total flow and the proportion of the sash opening or box that has reverse flow. The same analysis data is printed for reverse velocities calculated by:

increasing the reverse velocities by 20% of the sash opening velocity to identify sensitivity to disruption,

or alternatively by:

increasing the reverse velocity by adding the turbulence intensity, to provide a measure of velocity allowing for time averaged turbulent fluctuation.

LEAKAGE FACTOR : An artificial source of contamination is provided across the sash opening just inside the hood such that the entire air flow into the hood is completely contaminated. This allows the program to calculate dilution out into the laboratory and the flux of contamination moving out and away from hood. This listing identifies the leakage as the sum of the and diffusive fluxes that produce a concentration flow out of the sash opening into the 'working zone' or box around it, and through the box surface into the body of the laboratory thus representing the potential for leakage. The calculation is further described in Volume I, section 2.56.

The sash opening is chosen as this opening, where the air enters the hood, representing the boundary of the containment device, and beyond which the chemicals may be used.

The working zone or box was chosen to represent the boundary of the volume just outside the sash opening in which a scientist may work.

As such the leakage from the sash opening represents the contamination that may affect the scientist working at the hood, while the leakage from the box represents that which may affect scientists working elsewhere in the laboratory.

The leakage through the sash opening can be characterized by a leakage factor a s follows:

The sash leakage factor is the concentration as a fraction of the hood flow that leaks backwards against the flow and out of the hood through the sash opening into the laboratory, or more specifically the working zone or box. For example, in the large laboratory base case (run 041) the leakage is 0.00369, which represents 0.369% of the design hood flow-rate.

The box leakage can be characterized in a similar manner:

The box leakage factor represents the concentration leakage as a fraction of the hood flow out through the five faces of the box into the laboratory, away from the hood. For the large laboratory base case run 041, 0.000086 represents less than $^{1}/100^{th}$ of 1% leaking backwards against the flow. This is the amount of contamination leaking from

the imaginary box (working zone) in to the laboratory space if the hood is filled with contaminant.

The box leakage factor represents the overall leakage into the laboratory, which itself is dependent on the quantity of concentration that has already leaked through the sash opening.

Casename run000

Date 11/15/95

Description

Model Internal
Flow
Application Types Fume Hood
Case Description
Basic reference case used in analysis hood -783 cfm (face velocity 100 fpm)

Parametric Variation

Specialist Devices Fume hood
Thermal yes **Buoyancy** Boussinesq **Radiation** None **Comfort Temp** no
Concentration from hood **Turbulence** ke model **Special**
Dimensionality 3d Steady **A-Array Size** 1 Mwords **Grid Dimensions:** **X** 26 **Y** 21 **Z** 25

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean **Standard Deviation** **Maximum**

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:				
Box:				

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean **Standard Deviation** **Maximum**

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:				
Box:				

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:			
Box:			

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:			
Box:			

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:			
Box:			

Leakage Factor (leakage from a completely contaminated hood)
Sash Leakage / Hood Flow **Sash Leakage Area / Face Area**
Box Leakage / Hood Flow **Box Leakage Area / Box Surface Area**

Casename run001

Date 10/16/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description

Large laboratory (33 x 22), hood 50 fpm, 8.1 ACH, Tsup 53°F 11.7°C, heat load 7.75 W/ft² (conv.420W, rad.1084W, equip.4125W)

Parametric Variation

Ventilated ceiling total flow rate 979 cfm, hood -730 cfm, dropper -349 cfm, makeup via door 100 cfm **UNSTABLE**

Specialist Devices	Ceiling diffuser			Fume hood								
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no				
Concentration	from hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	3	Mwords	**Grid Dimensions:**	**X**	56	**Y**	46	**Z**	38	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	**Standard Deviation**	**Maximum**

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:				
Box:				

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	**Standard Deviation**	**Maximum**

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:				
Box:				

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:			
Box:			

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:			
Box:			

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:			
Box:			

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	**Sash Leakage Area / Face Area**
Box Leakage / Hood Flow	**Box Leakage Area / Box Surface Area**

Casename run002

Date 10/16/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description

Large laboratory (33 x 22), hood 50 fpm, 8.1 ACH, Tsup 53°F 11.7°C, heat load 7.75 W/ft² (conv.420W, rad.1084W, equip.4125W)

Parametric Variation

4 off Square diffusers SQ C.1 total flow rate 979 cfm, hood -365 cfm, dropper -714 cfm, makeup via door 100 cfm

Specialist Devices	Square diffuser			Fume hood							
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no			
Concentration	from hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	2 Mwords	**Grid Dimensions:**	**X**	56	**Y**	40	**Z**	33	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean 0.329 **Standard Deviation** 0.155 **Maximum** 0.699

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.52	0.646	0.492	0.606
Box:	0.685	1.63	0.522	1.22

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean 1.24 **Standard Deviation** 0.892 **Maximum** 3.14

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0677	0.0672	0.536	0.27
Box:	0.388	0.198	0.879	50.4

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0401	0.00402	0.0366

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.14	0.127	0.594

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.121	0.063	0.303

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00313	**Sash Leakage Area / Face Area**	0.517
Box Leakage / Hood Flow	0.000462	**Box Leakage Area / Box Surface Area**	0.599

Casename run003

Date 10/16/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 50 fpm, 8.1 ACH, Tsup 53°F 11.7°C, heat load 8.0 W/ft² (conv.420W, rad.1084W, equip.4125W)
Parametric Variation
4 off Square diffusers SQ C.2 total flow rate 979 cfm, hood -365 cfm, dropper -714 cfm, makeup via door 100 cfm

Specialist Devices	Square diffuser			Fume hood							
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no			
Concentration	from hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	2	Mwords	**Grid Dimensions:**	**X**	56	**Y**	40	**Z**	36

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.291 **Standard Deviation** 0.183 **Maximum** 0.719

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.526	0.664	0.478	0.601
Box:	0.77	1.7	0.573	1.24

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 1.28 **Standard Deviation** 0.885 **Maximum** 2.9

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0826	0.0654	0.661	0.298
Box:	0.532	0.342	1.16	77.4

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0578	0.0111	0.0756

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.158	0.164	0.653

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.143	0.112	0.436

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00332	**Sash Leakage Area / Face Area**	0.525
Box Leakage / Hood Flow	0.000771	**Box Leakage Area / Box Surface Area**	0.555

Casename run005

Date 11/2/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 50 fpm, 8.1 ACH, Tsup 53°F 11.7°C, heat load 7.75 W/ft² (conv.420W, rad.1084W, equip.4125W)
Parametric Variation

Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no				
Concentration	from hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	3	Mwords	**Grid Dimensions:**	**X**	65	**Y**	39	**Z**	36	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.289 **Standard Deviation** 0.164 **Maximum** 0.977

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.547	0.639	0.497	0.591
Box:	0.837	1.81	0.653	1.25

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 1.24 **Standard Deviation** 0.907 **Maximum** 3.23

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.08	0.0721	1.08	0.452
Box:	0.474	0.341	1.8	282

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0743	0.00732	0.0671

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.174	0.149	0.625

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.183	0.167	0.673

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00529	**Sash Leakage Area / Face Area**	0.461
Box Leakage / Hood Flow	0.00148	**Box Leakage Area / Box Surface Area**	0.625

Casename run004

Date 10/16/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description

Large laboratory (33 x 22), hood 50 fpm, 8.1 ACH, Tsup 53°F 11.7°C, heat load 7.75 W/ft² (conv.420W, rad.1084W, equip.4125W)

Parametric Variation

2 off Square diffusers TAD A.2 total flow rate 979 cfm, hood -365 cfm, dropper -714 cfm, makeup via door 100 cfm

Specialist Devices	TAD	Square diffuser		**Fume hood**		Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	from hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	3	Mwords	**Grid Dimensions:**	**X**	60	**Y**	45	**Z**	38

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean 0.329 **Standard Deviation** 0.161 **Maximum** 0.74

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.533	0.636	0.505	0.591
Box:	0.734	1.64	0.587	1.3

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean 1.25 **Standard Deviation** 0.773 **Maximum** 2.74

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0733	0.0592	0.808	0.398
Box:	0.318	0.281	1.44	125

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0371	0.00264	0.0252

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.137	0.118	0.541

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.139	0.0968	0.506

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0041	**Sash Leakage Area / Face Area**	0.449
Box Leakage / Hood Flow	0.000672	**Box Leakage Area / Box Surface Area**	0.794

Casename run007

Date 11/2/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 50 fpm, 8.1 ACH, Tsup 53°F 11.7°C, heat load 7.75 W/ft² (conv.420W, rad.1084W, equip.4125)
Parametric Variation

Specialist Devices	TAD			Fume hood							
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no			
Concentration	from hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	3	Mwords	**Grid Dimensions:**	**X**	60	**Y**	45	**Z**	38

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.294	**Standard Deviation**	0.164	**Maximum**	0.72

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.557	0.661	0.514	0.605
Box:	0.857	2.03	0.729	1.39

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	1.24	**Standard Deviation**	0.846	**Maximum**	2.65

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0673	0.0496	1.22	0.514
Box:	0.337	0.288	2.15	306

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.111	0.0112	0.0497

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.211	0.132	0.55

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.261	0.195	0.692

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00652	**Sash Leakage Area / Face Area**	0.478
Box Leakage / Hood Flow	0.00173	**Box Leakage Area / Box Surface Area**	0.752

Casename run006

Date 11/2/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description

Large laboratory (33 x 22), hood 50 fpm, 8.1 ACH, Tsup 53°F 11.7°C, heat load 7.75 W/ft² (conv.420W, rad.1084W, equip.4125W)

Parametric Variation

4 off Radial diffusers TAD-3 Total flow rate 979 cfm, 365 cfm per diffuser, 714 cfm make up air 100 cfm

Specialist Devices		Downflow diffuser			Fume hood						
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no			
Concentration	from hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	2	Mwords	**Grid Dimensions:**	**X**	57	**Y**	42	**Z**	36

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.347	Standard Deviation	0.155	Maximum	0.804

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.521	0.63	0.49	0.612
Box:	0.675	1.55	0.515	1.29

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	1.23	Standard Deviation	0.81	Maximum	2.6

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0698	0.0643	0.547	0.299
Box:	0.33	0.232	0.905	43.9

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0194	0.000955	0.0186

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.119	0.12	0.572

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.104	0.0577	0.325

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00287	**Sash Leakage Area / Face Area**	0.5
Box Leakage / Hood Flow	0.000363	**Box Leakage Area / Box Surface Area**	0.728

Casename run009

Date 10/16/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm, 8.1 ACH, Tsup 53°F 11.7°C, heat load 7.75 W/ft² (conv.420W, rad.1084W, equip.4125W)
Parametric Variation
4 off Downflow diffusers DOWN A.2 total flow rate 979 cfm, hood -365 cfm, dropper -714 cfm, makeup via door 100 cfm

Specialist Devices	Downflow diffuser			Fume hood							
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no			
Concentration	from hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	2	Mwords	**Grid Dimensions:**	**X**	60	**Y**	37	**Z**	35

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.32 **Standard Deviation** 0.134 **Maximum** 0.636

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.546	0.619	0.521	0.573
Box:	0.789	1.66	0.659	1.26

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 1.3 **Standard Deviation** 0.861 **Maximum** 2.93

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0663	0.0645	1.06	0.492
Box:	0.278	0.179	1.87	236

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0368	0.00291	0.0252

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.137	0.105	0.543

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.145	0.119	0.624

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00534	**Sash Leakage Area / Face Area**	0.446
Box Leakage / Hood Flow	0.00103	**Box Leakage Area / Box Surface Area**	0.735

Casename run008

Date 11/2/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 50 fpm, 8.1 ACH, Tsup 53°F 11.7°C, heat load 7.75 W/ft² (conv.420W, rad.1084W, equip.4125W)

Parametric Variation
Ventilated ceiling total flow rate 979 cfm, hood -730 cfm, dropper -349 cfm, makeup via door 100 cfm **UNSTABLE**

Specialist Devices	Ceiling diffuser			Fume hood							
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no			
Concentration	from hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	3 Mwords	**Grid Dimensions:**	**X**	56	**Y**	46	**Z**	38	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	**Standard Deviation**	**Maximum**

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:				
Box:				

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	**Standard Deviation**	**Maximum**

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:				
Box:				

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:			
Box:			

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:			
Box:			

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:			
Box:			

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	**Sash Leakage Area / Face Area**
Box Leakage / Hood Flow	**Box Leakage Area / Box Surface Area**

Casename run011

Date 10/16/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm, 8.1 ACH, Tsup 53°F 11.7°C, heat load 7.75 W/ft² (conv.420W, rad.1084W, equip.4125W)
Parametric Variation
4 off Square diffusers SQ C.1 total flow rate 979 cfm, hood -730 cfm, dropper -349 cfm, makeup via door 100 cfm

Specialist Devices	Square diffuser			Fume hood							
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no			
Concentration	from hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	3 Mwords	**Grid Dimensions:**	**X**	64	**Y**	39	**Z**	36	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.303 **Standard Deviation** 0.187 **Maximum** 0.806

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.324	0.393	0.329	0.392
Box:	0.746	2.07	0.757	1.98

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.622 **Standard Deviation** 0.429 **Maximum** 1.34

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0692	0.0639	0.273	0.138
Box:	0.241	0.117	0.429	12.4

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0	0	0

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0985	0.0317	0.151

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.123	0.0482	0.172

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00469	**Sash Leakage Area / Face Area**	0.533
Box Leakage / Hood Flow	0.000241	**Box Leakage Area / Box Surface Area**	0.551

Casename run010

Date 11/2/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm, 8.1 ACH, Tsup 53°F 11.7°C, heat load 7.75 W/ft² (conv.420W, rad.1084W, equip.4125W)
Parametric Variation
4 off Square diffusers SQ C.3 total flow rate 979 cfm, hood -730 cfm, dropper -349 cfm, makeup via door 100 cfm

Specialist Devices	Square diffuser			Fume hood							
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no			
Concentration	from hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	3 Mwords	**Grid Dimensions:**	**X**	72	**Y**	41	**Z**	36	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.331 **Standard Deviation** 0.232 **Maximum** 1.23

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.372	0.418	0.382	0.43
Box:	0.862	2.34	0.885	2.27

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.62 **Standard Deviation** 0.438 **Maximum** 1.49

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0684	0.0569	0.48	0.215
Box:	0.294	0.119	0.728	27.3

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0251	0.00122	0.0155

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.125	0.037	0.146

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.147	0.0709	0.215

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00603	**Sash Leakage Area / Face Area**	0.479
Box Leakage / Hood Flow	0.000404	**Box Leakage Area / Box Surface Area**	0.461

Casename run013

Date 11/2/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm, 8.1 ACH, Tsup 53°F 11.7°C, heat load 7.75 W/ft² (conv.420W, rad.1084W, equip.4125W)
Parametric Variation
2 off Radial diffusers TAD A.2 total flow rate 979 cfm, hood -730 cfm, dropper -349 cfm, makeup via door 100 cfm

Specialist Devices	TAD			Fume hood							
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no			
Concentration	from hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	3	Mwords	**Grid Dimensions:**	**X**	56	**Y**	47	**Z**	39

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.351 **Standard Deviation** 0.303 **Maximum** 1.59

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.382	0.429	0.384	0.429
Box:	0.853	1.69	0.909	1.82

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.634 **Standard Deviation** 0.421 **Maximum** 1.59

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.824	0.832	2.07	0.261
Box:	0.955	1.13	2.71	30.2

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0296	0.00116	0.0109

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.13	0.0276	0.122

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.168	0.0624	0.267

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00604	**Sash Leakage Area / Face Area**	0.511
Box Leakage / Hood Flow	0.000373	**Box Leakage Area / Box Surface Area**	0.711

Casename run012

Date 11/2/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm, 8.1 ACH, Tsup 53°F 11.7°C, heat load 8.0 W/ft² (conv.840W, rad.845W, equip.4125W)
Parametric Variation
2 off Radial diffusers TAD A.3 total flow rate 979 cfm, hood -730 cfm, dropper -394 cfm, makeup via door 100 cfm

Specialist Devices	TAD			Fume hood								
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no				
Concentration	from hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	3	Mwords	**Grid Dimensions:**	**X**	55	**Y**	48	**Z**	39	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.318 **Standard Deviation** 0.235 **Maximum** 1.15

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.429	0.501	0.429	0.511
Box:	0.969	1.83	1	2

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.644 **Standard Deviation** 0.448 **Maximum** 1.61

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0638	0.0543	0.699	0.31
Box:	0.203	0.109	1.1	53.6

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0559	0.00262	0.017

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.156	0.0304	0.121

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.219	0.108	0.337

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00775	**Sash Leakage Area / Face Area**	0.456
Box Leakage / Hood Flow	0.00061	**Box Leakage Area / Box Surface Area**	0.55

Casename run015

Date 10/16/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description

Large laboratory (33 x 22), hood 50 fpm, 10.0 ACH, Tsup 58.8°F 14.9°C, heat load 7.75 W/ft² (conv.420W, rad.1084W, equip.4125W)

4 off Downflow diffusers DOWN A.2 total flow rate 979 cfm

Specialist Devices	Downflow diffuser			Fume hood							
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no			
Concentration	from hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	3 Mwords	**Grid Dimensions:**	**X**	66	**Y**	43	**Z**	37	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean 0.28 **Standard Deviation** 0.192 **Maximum** 1.12

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.389	0.43	0.39	0.44
Box:	0.852	2.04	0.88	2.02

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean 0.65 **Standard Deviation** 0.444 **Maximum** 1.53

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0632	0.064	0.547	0.248
Box:	0.207	0.0967	0.831	23.2

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.00572	0.000112	0.0037

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.106	0.0185	0.13

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.144	0.0487	0.238

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00629	**Sash Leakage Area / Face Area**	0.446
Box Leakage / Hood Flow	0.000346	**Box Leakage Area / Box Surface Area**	0.639

Casename run014

Date 11/2/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description

Large laboratory (33 x 22), hood 100 fpm, 8.1 ACH, Tsup 53°F 11.7°C, heat load 7.75 W/ft² (conv.420W, rad.1084W, equip.4125W)

Parametric Variation

Parametric Variation

4 off Square diffusers SQ C.2 total flow rate 1211 cfm, hood -365 cfm, dropper -946 cfm, makeup via door 100 cfm

Specialist Devices	Square diffuser			Fume hood								
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	from hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	2 Mwords	**Grid Dimensions:**	**X**	56	**Y**	42	**Z**	36		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean 0.251 **Standard Deviation** 0.176 **Maximum** 0.748

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.532	0.693	0.483	0.574
Box:	0.768	1.69	0.577	1.25

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean 1.19 **Standard Deviation** 0.777 **Maximum** 2.48

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.087	0.0365	0.782	0.329
Box:	0.488	0.41	1.36	83.7

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0595	0.0152	0.119

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.159	0.149	0.502

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.14	0.124	0.399

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0044	**Sash Leakage Area / Face Area**	0.476
Box Leakage / Hood Flow	0.000948	**Box Leakage Area / Box Surface Area**	0.734

Casename run017

Date 11/2/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm, 8.1 ACH, Tsup 53°F 11.7°C, heat load 8.0 W/ft² (conv.840W, rad.845W, equip.4125W)
Parametric Variation
2 off Tad diffusers TAD A.1 total flow rate 979 cfm, hood-365 cfm, dropper -714 cfm, makeup via door 100 cfm

Specialist Devices	TAD			Fume hood							
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no			
Concentration	from hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	3 Mwords	**Grid Dimensions:**	**X**	62	**Y**	44	**Z**	37	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.348 **Standard Deviation** 0.156 **Maximum** 0.682

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.531	0.634	0.5	0.588
Box:	0.698	1.53	0.57	1.16

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 1.28 **Standard Deviation** 0.9 **Maximum** 4.25

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0713	0.0609	0.764	0.337
Box:	0.321	0.203	1.21	69.7

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0181	0.000802	0.0176

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.118	0.117	0.584

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0858	0.0672	0.404

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0036	**Sash Leakage Area / Face Area**	0.439
Box Leakage / Hood Flow	0.000416	**Box Leakage Area / Box Surface Area**	0.783

Casename run016

Date 11/2/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 50 fpm, 8.1 ACH, Tsup 53°F 11.7°C, heat load 8.0 W/ft² (conv.840W, rad.845W, equip.4125W)
Parametric Variation
2 off Tad diffusers TAD A.1 total flow rate 979 cfm, hood-730 cfm, dropper -349 cfm, makeup via door 100 cfm

Specialist Devices	TAD			Fume hood							
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no			
Concentration	from hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	3 Mwords	**Grid Dimensions:**	**X**	62	**Y**	44	**Z**	37	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.217 **Standard Deviation** 0.154 **Maximum** 0.794

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.35	0.39	0.35	0.402
Box:	0.734	1.74	0.751	1.79

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.637 **Standard Deviation** 0.416 **Maximum** 1.37

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0666	0.0698	0.381	0.179
Box:	0.144	0.068	0.529	9.41

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0	0	0

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0514	0.00762	0.0848

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0452	0.0081	0.0873

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00457	**Sash Leakage Area / Face Area**	0.555
Box Leakage / Hood Flow	0.000153	**Box Leakage Area / Box Surface Area**	0.583

Casename run019

Date 11/6/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 50 fpm, 8.1 ACH, Tsup 53°F 11.7°C, heat load 7.75 W/ft² (conv.420W, rad.1084W, equip.4125W)
Parametric Variation
4 off Square diffusers SQ C.1 total flow rate 979 cfm, hood -365 cfm, dropper -614 cfm

Specialist Devices	Square diffuser			Fume hood							
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no			
Concentration	from hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	3 Mwords	**Grid Dimensions:**	**X**	62	**Y**	49	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.299 **Standard Deviation** 0.167 **Maximum** 0.685

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.52	0.646	0.486	0.599
Box:	0.675	1.7	0.501	1.19

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 1.23 **Standard Deviation** 0.843 **Maximum** 2.78

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0725	0.0605	0.521	0.223
Box:	0.443	0.233	0.875	49.3

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0577	0.00732	0.0451

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.158	0.129	0.542

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.137	0.0684	0.302

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00298	**Sash Leakage Area / Face Area**	0.55
Box Leakage / Hood Flow	0.000457	**Box Leakage Area / Box Surface Area**	0.534

Casename run018

Date 11/6/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 50 fpm, 8.1 ACH, Tsup 53°F 11.7°C, heat load 7.75 W/ft² (conv.420W, rad.1084W, equip.4125W)

Parametric Variation
4 off Square diffusers SQ C.2 total flow rate 979 cfm, hood -365 cfm, dropper -614 cfm

Specialist Devices	Square diffuser			Fume hood							
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no			
Concentration	from hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	3 Mwords	**Grid Dimensions:**	**X**	59	**Y**	48	**Z**	37	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.288	**Standard Deviation**	0.198	**Maximum**	1.1

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.53	0.692	0.465	0.591
Box:	0.777	1.87	0.584	1.26

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	1.22	**Standard Deviation**	0.851	**Maximum**	3.23

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0878	0.0631	0.737	0.317
Box:	0.559	0.458	1.28	76.5

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0943	0.0142	0.102

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.194	0.167	0.584

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.19	0.129	0.443

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00384	**Sash Leakage Area / Face Area**	0.485
Box Leakage / Hood Flow	0.000977	**Box Leakage Area / Box Surface Area**	0.625

Casename run020

Date 11/2/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 50 fpm, 8.1 ACH, Tsup 53°F 11.7°C, heat load 8.0 W/ft² (conv.840W, rad.845W, equip.4125W)
Parametric Variation
2 off Radial diffusers TAD A.1 total flow rate 979 cfm, hood -365 cfm, dropper -614 cfm

Specialist Devices	TAD			Fume hood							
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no			
Concentration	from hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	3 Mwords	**Grid Dimensions:**	**X**	54	**Y**	45	**Z**	39	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	Standard Deviation	Maximum
0.333	0.162	0.681

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.533	0.641	0.499	0.594
Box:	0.714	1.6	0.579	1.28

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	Standard Deviation	Maximum
1.28	0.912	3.05

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0685	0.0607	0.803	0.359
Box:	0.338	0.232	1.28	83.3

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.036	0.00288	0.0325

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.136	0.121	0.56

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.112	0.0808	0.443

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00393	**Sash Leakage Area / Face Area**	0.429
Box Leakage / Hood Flow	0.00055	**Box Leakage Area / Box Surface Area**	0.803

Casename run021

Date 11/2/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 50 fpm, 8.1 ACH, Tsup 53°F 11.7°C, heat load 8.0 W/ft² (conv.840W, rad.845W, equip.4125W)
Parametric Variation
4 off Downflow diffusers DOWN A.1 total flow rate 979 cfm, hood -365 cfm, dropper -614 cfm

Specialist Devices	Downflow diffuser			Fume hood							
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no			
Concentration	from hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	3	Mwords	**Grid Dimensions:**	**X**	57	**Y**	49	**Z**	37

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.347	**Standard Deviation**	0.148	**Maximum**	0.703

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.525	0.616	0.488	0.601
Box:	0.7	1.62	0.551	1.22

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	1.23	**Standard Deviation**	0.89	**Maximum**	3.04

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0656	0.0623	0.635	0.265
Box:	0.391	0.18	0.984	44.8

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0393	0.00351	0.0389

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.139	0.131	0.617

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.118	0.0637	0.347

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00305	**Sash Leakage Area / Face Area**	0.505
Box Leakage / Hood Flow	0.000445	**Box Leakage Area / Box Surface Area**	0.573

Casename run022

Date 11/2/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 50 fpm, 8.1 ACH, Tsup 53°F 11.7°C, heat load 8.0 W/ft² (conv.840W, rad.845W, equip.4125W)

Parametric Variation
4 off Large Downflow diffusers DOWN B.1 total flowrate 979 cfm, hood -365 cfm, dropper -714 cfm, makeup via door 100 cfm

Specialist Devices	Downflow diffuser			Fume hood								
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	from hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	3	Mwords	**Grid Dimensions:**	**X**	62	**Y**	48	**Z**	37	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.309	**Standard Deviation**	0.169	**Maximum**	0.712

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.53	0.637	0.492	0.612
Box:	0.723	1.69	0.557	1.23

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	1.22	**Standard Deviation**	0.863	**Maximum**	2.99

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0698	0.0636	0.743	0.439
Box:	0.446	0.227	1.16	610

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0545	0.00549	0.0363

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.155	0.138	0.636

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.143	0.0899	0.419

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00138	**Sash Leakage Area / Face Area**	0.296
Box Leakage / Hood Flow	0.00052	**Box Leakage Area / Box Surface Area**	0.17

Casename run023

Date 11/6/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Large Laboratory (33 x 22), hood 50 fpm, 8.1 ACH, Tsup 53°F 11.7°C, heat load 8.0 W/ft² total (conv.840W, rad.845W, equip.4125W)

Parametric Variation
4 off Large Downflow diffusers DOWN B.2 total flow rate979 cfm, hood -365 cfm, dropper -714 cfm, makeup via door 100 cfm

Specialist Devices	Downflow diffuser			Fume hood							
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no			
Concentration	from hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	3	Mwords	**Grid Dimensions:**	**X**	62	**Y**	48	**Z**	37

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.302	**Standard Deviation**	0.138	**Maximum**	0.644

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.555	0.633	0.525	0.577
Box:	0.808	1.63	0.678	1.27

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	1.28	**Standard Deviation**	0.857	**Maximum**	3.47

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0714	0.0547	1.22	0.534
Box:	0.301	0.199	2.08	282

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0301	0.00242	0.028

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.13	0.106	0.542

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.138	0.145	0.678

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00608	**Sash Leakage Area / Face Area**	0.425
Box Leakage / Hood Flow	0.00149	**Box Leakage Area / Box Surface Area**	0.744

Casename run025

Date 11/6/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Large Laboratory (33 x 22), hood 50 fpm (25%open), 8.1 ACH, Tsup 53°F, 11.7°C, heat load 8.0 W/ft² (conv.840W, rad.845W, equip.4125W)

Parametric Variation
4 off Large Downflow diffusers DOWN B.1 total flow rate979 cfm, hood -730 cfm, dropper -349 cfm, makeup via door 100 cfm

Specialist Devices	Downflow diffuser			Fume hood							
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no			
Concentration	from hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	3	Mwords	**Grid Dimensions:**	**X**	62	**Y**	48	**Z**	37

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.26	**Standard Deviation**	0.162	**Maximum**	0.733

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.36	0.42	0.366	0.414
Box:	0.792	2.26	0.8	2.12

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.641	**Standard Deviation**	0.457	**Maximum**	1.59

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0653	0.0645	0.429	0.204
Box:	0.239	0.106	0.598	16.1

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0	0	0

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0972	0.0207	0.125

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.121	0.0427	0.17

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0054	**Sash Leakage Area / Face Area**	0.496
Box Leakage / Hood Flow	0.00034	**Box Leakage Area / Box Surface Area**	0.579

Casename run024

Date 11/6/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Large Laboratory (33 x 22), hood 100 fpm, 8.1 ACH, Tsup 53°F 11.7°C, heat load 8.0 W/ft² total (conv.840W, rad.845W, equip.4125W)

Parametric Variation
4 off Square diffusers SQ C.2 total flow rate 979 cfm

Specialist Devices	Square diffuser			Fume hood								
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no				
Concentration	from hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	3 Mwords	**Grid Dimensions:**	**X**	58	**Y**	50	**Z**	35		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.355 **Standard Deviation** 0.162 **Maximum** 0.959

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.577	0.573	0.544	0.548
Box:	1.59	3.42	1.45	3.01

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.958 **Standard Deviation** 0.676 **Maximum** 2.26

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.145	0.0829	3.15	0.275
Box:	2.06	0.735	9.34	202000

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.202	0.29	0.294

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.302	0.875	0.738

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.264	0.677	0.693

Leakage Factor (leakage from a completely contaminated hood)
Sash Leakage / Hood Flow 0.00242 **Sash Leakage Area / Face Area** 1.04
Box Leakage / Hood Flow 0.00243 **Box Leakage Area / Box Surface Area** 0.712

Casename run027

Date 11/6/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Large Laboratory (33 x 22), hood 50 fpm, opening 25%, 8.1 ACH, Tsup 53°F, 11.7°C, heat load 8.0 W/ft² (conv.840W, rad.845W, equip.4125W)

Parametric Variation
2 off Radial diffusers TAD A.1 total flow rate 979 cfm, hood -365 cfm, dropper -714 cfm, makeup via door 100 cfm

Specialist Devices	TAD			Fume hood								
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no				
Concentration	from hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	3	Mwords	**Grid Dimensions:**	**X**	52	**Y**	47	**Z**	39	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.416	**Standard Deviation**	0.169	**Maximum**	0.669

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.468	0.52	0.478	0.51
Box:	1.22	2.22	1.1	2.23

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	1.66	**Standard Deviation**	1.64	**Maximum**	4.74

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0983	0.0805	3.7	0.528
Box:	0.814	0.258	9.53	322000

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0748	0.0542	0.204

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.175	0.644	0.746

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.149	0.439	0.683

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00149	**Sash Leakage Area / Face Area**	0.518
Box Leakage / Hood Flow	0.000807	**Box Leakage Area / Box Surface Area**	0.798

Casename run026

Date 11/6/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Large Laboratory (33 x 22), hood 50 fpm, hood opening 25%, 8.1 ACH, Tsup 53°F, 11.7°C, heat load 8.0 W/ft² (conv.840W, rad.845W, equip.4125W)

Parametric Variation
4 off Downflow diffusers DOWN A.1 total flow rate 979 cfm, hood -365 cfm, dropper -714 cfm, makeup via door 100 cfm

Specialist Devices	Downflow diffuser			Fume hood							
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no			
Concentration	from hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	3	Mwords	**Grid Dimensions:**	**X**	52	**Y**	47	**Z**	39

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.444 **Standard Deviation** 0.157 **Maximum** 0.721

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.461	0.529	0.456	0.533
Box:	1.3	2.95	1.07	2.72

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.852 **Standard Deviation** 0.841 **Maximum** 2.82

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.103	0.072	3.13	0.23
Box:	1.19	0.3	7.81	190000

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.144	0.159	0.276

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.244	0.733	0.72

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.2	0.467	0.6

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00112	**Sash Leakage Area / Face Area**	0.556
Box Leakage / Hood Flow	0.00067	**Box Leakage Area / Box Surface Area**	0.565

Casename run029

Date 11/6/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Large Laboratory (33 x 22), hood 50 fpm, 8.1 ACH, Tsup 62.25°F 16.8°C, heat load 5.16 W/ft² (conv.840W, rad.845W, equip.2063W)
Parametric Variation
4 off Square diffusers SQ C.2 total flow rate 979 cfm, hood -365 cfm, dropper -714 cfm, makeup via door 100 cfm

Specialist Devices	Square diffuser			Fume hood							
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no			
Concentration	from hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	3 Mwords	**Grid Dimensions:**	**X**	63	**Y**	43	**Z**	37	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.296 **Standard Deviation** 0.176 **Maximum** 0.706

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.522	0.672	0.476	0.583
Box:	0.698	1.69	0.504	1.23

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 1.29 **Standard Deviation** 0.938 **Maximum** 3.1

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0854	0.0509	0.552	0.216
Box:	0.468	0.284	0.889	35.2

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0573	0.00596	0.0516

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.157	0.152	0.654

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.134	0.0734	0.38

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00294	**Sash Leakage Area / Face Area**	0.554
Box Leakage / Hood Flow	0.000384	**Box Leakage Area / Box Surface Area**	0.655

Casename run028

Date 11/6/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Large Laboratory (33 x 22), hood 50 fpm, 8.1 ACH, Tsup 62.25°F 16.8°C, heat load 5.16 W/ft² (conv.840W, rad.845W, equip.2063W)
Parametric Variation
2 off Radial diffusers TAD A.1 total flow rate 979 cfm, hood -365 cfm, dropper -714 cfm, makeup via door 100 cfm

Specialist Devices	TAD			Fume hood							
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no			
Concentration	from hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	3 Mwords	**Grid Dimensions:**	**X**	63	**Y**	43	**Z**	37	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.339 **Standard Deviation** 0.16 **Maximum** 0.693

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.528	0.641	0.493	0.591
Box:	0.686	1.52	0.548	1.31

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 1.28 **Standard Deviation** 0.901 **Maximum** 3.89

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0744	0.0571	0.697	0.306
Box:	0.329	0.212	1.11	53.9

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0165	0.000727	0.0145

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.117	0.119	0.576

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0835	0.0641	0.391

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0032	**Sash Leakage Area / Face Area**	0.502
Box Leakage / Hood Flow	0.000382	**Box Leakage Area / Box Surface Area**	0.836

Casename run031

Date 11/2/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 50 fpm, 8.1 ACH, Tsup 53°F 11.7°C, heat load 7.75 W/ft² (conv.420W, rad.1084W, equip.4125W)
Parametric Variation
4 off Downflow diffusers DOWN A.1 total flow rate 979 cfm, hood -365 cfm, dropper -714 cfm, makeup via door 100 cfm

Specialist Devices	Downflow diffuser			Fume hood							
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no			
Concentration	from hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	3	Mwords	**Grid Dimensions:**	**X**	63	**Y**	43	**Z**	37

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.3 **Standard Deviation** 0.178 **Maximum** 0.736

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.521	0.646	0.471	0.615
Box:	0.723	1.69	0.542	1.27

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 1.29 **Standard Deviation** 0.929 **Maximum** 3.63

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0784	0.0587	0.546	0.222
Box:	0.48	0.315	0.871	38.1

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0536	0.0108	0.105

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.154	0.154	0.564

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.141	0.0944	0.351

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00265	**Sash Leakage Area / Face Area**	0.533
Box Leakage / Hood Flow	0.00054	**Box Leakage Area / Box Surface Area**	0.532

Casename run030

Date 11/6/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Large Laboratory (33 x 22), hood 50 fpm, 8.1 ACH, Tsup 62.25°F 16.8°C, heat load 5.16 W/ft² (conv.840W, rad.845W, equip.2063W)

Parametric Variation
Person next to hood, 4 off Sqaure diffusers SQ C.2 total flow rate 979 cfm, hood -365 cfm, dropper -714 cfm, makeup via door 100 cfm

Specialist Devices	Square diffuser			Fume hood							
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no			
Concentration	from hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	3 Mwords	**Grid Dimensions:**	**X**	65	**Y**	49	**Z**	37	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 1.01 **Standard Deviation** -999 **Maximum** 1

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.521	0.707	1.02	1.03
Box:	0.768	2.01	1.1	1.51

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 1.21 **Standard Deviation** 0.974 **Maximum** 4.38

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0973	0.952	0.514	0.318
Box:	0.633	1.01	0.919	14

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.133	0.0198	0.0686

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.233	0.196	0.654

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.202	0.106	0.488

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00395	**Sash Leakage Area / Face Area**	0.607
Box Leakage / Hood Flow	0.000287	**Box Leakage Area / Box Surface Area**	0.477

Casename run032

Date 11/2/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 50 fpm, 8.1 ACH, Tsup 53°F 11.7°C, heat load 7.75 W/ft² (conv.420W, rad.1084W, equip.4125W)

Parametric Variation
Person next to hood, 2 off Radial diffusers TAD A.1 total flow rate 979 cfm, hood -365 cfm, dropper -714 cfm, makeup via door 100 cfm

Specialist Devices	TAD			Fume hood							
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	from hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	3 Mwords	**Grid Dimensions:**	**X**	64	**Y**	49	**Z**	37	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 1.01 **Standard Deviation** -999 **Maximum** 1

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.522	0.613	1.02	1.02
Box:	0.688	1.59	1.08	1.45

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 1.27 **Standard Deviation** 0.972 **Maximum** 4.08

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.101	0.952	0.522	0.337
Box:	0.415	1.01	0.861	11.4

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0364	0.00281	0.0362

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.136	0.142	0.585

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0973	0.0511	0.337

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00381	**Sash Leakage Area / Face Area**	0.587
Box Leakage / Hood Flow	0.000165	**Box Leakage Area / Box Surface Area**	0.539

Casename run033

Date 11/2/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description

Large laboratory (33 x 22), hood 50 fpm, 8.1 ACH, Tsup 53°F 11.7°C, heat load 7.75 W/ft² (conv.420W, rad.1084W, equip.4125W)

Parametric Variation

Person & trolley next to hood, 4 off Sqaure diffusers SQ C.2 total flow rate 979 cfm, hood -365 cfm, dropper -714 cfm, makeup via door

Specialist Devices	Square diffuser			Fume hood							
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no			
Concentration	from hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	60	**Y**	48	**Z**	35

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean 1.01 **Standard Deviation** -999 **Maximum** 1

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.51	0.756	1.01	1.02
Box:	0.906	1.65	1.17	1.48

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean 1 **Standard Deviation** 1.03 **Maximum** 5.75

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.196	0.952	0.276	0.128
Box:	0.656	1.01	0.438	3.23

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.051	0.00479	0.0498

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.151	0.241	0.659

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.119	0.0859	0.46

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00227	**Sash Leakage Area / Face Area**	0.572
Box Leakage / Hood Flow	0.000047	**Box Leakage Area / Box Surface Area**	0.212

Casename run034

Date 11/2/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 50 fpm, 8.1 ACH, Tsup 53°F 11.7°C, heat load 7.75 W/ft² (conv.420W, rad.1084W, equip.4125W)

Parametric Variation
Person & trolley next to hood, 2 off Radial diffusers TAD A.1 total flow rate 979 cfm, hood -365 cfm, dropper -714 cfm, makeup via

Specialist Devices	TAD			Fume hood							
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	from hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	3	Mwords	**Grid Dimensions:**	**X**	63	**Y**	49	**Z**	38

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	1.01	Standard Deviation	-999	Maximum	1

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.555	0.79	1.03	1.06
Box:	1.05	2.25	1.3	1.76

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.908	Standard Deviation	0.748	Maximum	2.81

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.202	0.952	0.939	0.291
Box:	0.597	1.01	1.9	121

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.146	0.0243	0.0578

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.246	0.217	0.521

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.332	0.22	0.677

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.007	**Sash Leakage Area / Face Area**	0.476
Box Leakage / Hood Flow	0.00171	**Box Leakage Area / Box Surface Area**	0.125

Casename run035

Date 11/6/95

Description

Model Internal
Flow Forced
Application Types Laboratory Fume hood

Case Description
Single fume hood, hood 50 fpm, extract on baffle

Parametric Variation
total extract 365 cfm

Specialist Devices Fume hood
Thermal no **Buoyancy** None **Radiation** None **Comfort Temp** no
Concentration from hood **Turbulence** ke model **Special**
Dimensionality 3d Steady **A-Array Size** 2 Mwords **Grid Dimensions:** **X** 36 **Y** 35 **Z** 42

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean **Standard Deviation** **Maximum**

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:				
Box:				

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean **Standard Deviation** **Maximum**

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:				
Box:				

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:			
Box:			

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:			
Box:			

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:			
Box:			

Leakage Factor (leakage from a completely contaminated hood)
Sash Leakage / Hood Flow **Sash Leakage Area / Face Area**
Box Leakage / Hood Flow **Box Leakage Area / Box Surface Area**

Casename run037

Date 11/6/95

Description

Model Internal
Flow Forced
Application Types Laboratory Fume hood

Case Description
Single fume hood, hood 50 fpm, extract on duct at roof level

Parametric Variation
total extract 365 cfm

Specialist Devices Fume hood
Thermal no **Buoyancy** None **Radiation** None **Comfort Temp** no
Concentration from hood **Turbulence** ke model **Special**
Dimensionality 3d Steady **A-Array Size** 2 Mwords **Grid Dimensions:** **X** 36 **Y** 35 **Z** 42

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

	Mean	Standard Deviation	Maximum

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:				
Box:				

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	Standard Deviation	Maximum

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:				
Box:				

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:			
Box:			

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:			
Box:			

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:			
Box:			

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	Sash Leakage Area / Face Area
Box Leakage / Hood Flow	Box Leakage Area / Box Surface Area

Casename run036

Date 11/6/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Single fume hood, hood 50 fpm, extract on top of hood

Parametric Variation
total extract 365 cfm

Specialist Devices					Fume hood								
Thermal	no	**Buoyancy**	None	**Radiation**	None	**Comfort Temp**	no						
Concentration	from hood	**Turbulence**	ke model	**Special**									
Dimensionality	3d Steady	**A-Array Size**	2	Mwords	**Grid Dimensions:**	**X**	36	**Y**	35	**Z**	42		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	**Standard Deviation**	**Maximum**

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:				
Box:				

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	**Standard Deviation**	**Maximum**

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:				
Box:				

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:			
Box:			

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:			
Box:			

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:			
Box:			

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	**Sash Leakage Area / Face Area**
Box Leakage / Hood Flow	**Box Leakage Area / Box Surface Area**

Casename run039

Date 11/6/95

Description

Model Internal
Flow Forced
Application Types Laboratory Fume hood

Case Description
Single fume hood, hood 50 fpm, by-pass as a simple hole, hood 25% open, by-pass 75% free area ratio

Parametric Variation
total extract 365 cfm

Specialist Devices Fume hood

Thermal	no	**Buoyancy**	None		**Radiation**	None	**Comfort Temp**		no			
Concentration	from hood	**Turbulence**	ke model		**Special**							
Dimensionality	3d Steady	**A-Array Size**	2	Mwords	**Grid Dimensions:**	**X**	36	**Y**	35	**Z**	42	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	**Standard Deviation**	**Maximum**

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:				
Box:				

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	**Standard Deviation**	**Maximum**

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:				
Box:				

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:			
Box:			

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:			
Box:			

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:			
Box:			

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	**Sash Leakage Area / Face Area**
Box Leakage / Hood Flow	**Box Leakage Area / Box Surface Area**

Casename run038

Date 11/6/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Single fume hood, hood 50 fpm, by-pass as a simple hole, hood 25% open

Parametric Variation
total extract 365 cfm

Specialist Devices					Fume hood								
Thermal	no	**Buoyancy**	None	**Radiation**	None	**Comfort Temp**	no						
Concentration	from hood	**Turbulence**	ke model	**Special**									
Dimensionality	3d Steady	**A-Array Size**	2	Mwords	**Grid Dimensions:**	**X**	36	**Y**	35	**Z**	42		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	**Standard Deviation**	**Maximum**

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:				
Box:				

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	**Standard Deviation**	**Maximum**

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:				
Box:				

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:			
Box:			

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:			
Box:			

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:			
Box:			

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	**Sash Leakage Area / Face Area**
Box Leakage / Hood Flow	**Box Leakage Area / Box Surface Area**

Casename run040

Date 11/6/95

Description

Model Internal
Flow Forced
Application Types Laboratory Fume hood

Case Description
Single fume hood, hood 50 fpm, 100% open with Person in front of hood.

Parametric Variation
total extract 365 cfm

Specialist Devices Fume hood

Thermal	no	**Buoyancy**	None		**Radiation**	None		**Comfort Temp**		no			
Concentration	from hood		**Turbulence**	ke model		**Special**							
Dimensionality	3d Steady	**A-Array Size**	2	Mwords	**Grid Dimensions:**	**X**	42	**Y**	45	**Z**	44		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	**Standard Deviation**	**Maximum**

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:				
Box:				

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	**Standard Deviation**	**Maximum**

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:				
Box:				

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:			
Box:			

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:			
Box:			

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:			
Box:			

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	**Sash Leakage Area / Face Area**
Box Leakage / Hood Flow	**Box Leakage Area / Box Surface Area**

Casename run041

Date 8/31/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F 12.8°C, heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
4 off square 12" layout SQ A.1 Hood -783 cfm, Trunk exhaust -413 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood		Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	57	**Y**	48	**Z**	34

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.56	**Standard Deviation**	0.424	**Maximum**	2.29

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.305	0.393	0.314	0.366
Box:	0.757	1.88	0.85	1.76

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.626	**Standard Deviation**	0.427	**Maximum**	1.34

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0386	0.0687	0.144	0.0425
Box:	0.369	0.31	0.229	1.55

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.107	0.0138	0.0535

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.207	0.0625	0.172

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.183	0.0631	0.15

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00369	**Sash Leakage Area / Face Area**	0.481
Box Leakage / Hood Flow	0.000086	**Box Leakage Area / Box Surface Area**	0.504

Casename run041b

Date 4/18/96

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description

Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F 12.8°C, heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation

4 off Perf (horizontal) 12" layout PERF A.1 Hood -783 cfm, Trunk exhaust -413 cfm, door crack 100 cfm

Specialist Devices	Perforated diff		Fume hood		Ceiling diffuser						
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	57	**Y**	48	**Z**	34

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean 0.596 **Standard Deviation** 0.496 **Maximum** 2.86

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.322	0.405	0.327	0.394
Box:	0.82	2.45	0.922	1.86

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean 0.624 **Standard Deviation** 0.403 **Maximum** 1.32

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0624	0.077	0.187	0.0498
Box:	0.418	0.349	0.31	2.24

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.235	0.0285	0.0498

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.335	0.0847	0.192

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.31	0.0927	0.217

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00421	**Sash Leakage Area / Face Area**	0.49
Box Leakage / Hood Flow	0.000126	**Box Leakage Area / Box Surface Area**	0.543

Casename run042

Date 8/31/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off square - layout SQ B.1 Hood -783 cfm, Trunk exhaust -413 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	7	Mwords	**Grid Dimensions:**	**X**	59	**Y**	58	**Z**	41	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.319	**Standard Deviation**	0.252	**Maximum**	1.09

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.358	0.429	0.362	0.486
Box:	0.793	2.2	0.805	2.28

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.644	**Standard Deviation**	0.442	**Maximum**	1.88

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0292	0.0384	0.307	1.13
Box:	0.236	0.152	0.434	8.93

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0152	0.000168	0.00442

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.115	0.0294	0.152

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.128	0.0458	0.205

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0105	**Sash Leakage Area / Face Area**	0.483
Box Leakage / Hood Flow	0.000407	**Box Leakage Area / Box Surface Area**	0.589

Casename run043

Date 8/31/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 (100%) fpm, Supply 1097 cfm (9.1 ACH), Tsup 55°F 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
4 off square layout SQ A.1. Person 4 inches from hood Hood -783 cfm, trunk exhaust -413 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	10	Mwords	**Grid Dimensions:**	**X**	63	**Y**	64	**Z**	41	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.576 **Standard Deviation** 0.327 **Maximum** 1.61

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.417	1.46	0.426	1.46
Box:	0.972	2.96	0.971	2.67

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.527 **Standard Deviation** 0.527 **Maximum** 2.64

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.222	0.224	0.205	0.945
Box:	0.514	0.32	0.311	3.22

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.155	0.0221	0.0646

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00137	0.00685
Box:	0.255	0.118	0.31

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.182	0.00233	0.00685
Box:	0.233	0.112	0.292

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.013	**Sash Leakage Area / Face Area**	0.601
Box Leakage / Hood Flow	0.000117	**Box Leakage Area / Box Surface Area**	0.408

Casename run044

Date 8/31/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
4 off square 12" layout SQ A.1. Person 6 inches from hood Hood -783 cfm, Trunk exhaust -413 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser				
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	10 Mwords	**Grid Dimensions:**	**X**	63	**Y**	64	**Z**	41	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.554	**Standard Deviation**	0.335	**Maximum**	1.6

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.362	1.46	0.382	1.46
Box:	0.953	2.55	0.935	2.34

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.555	**Standard Deviation**	0.524	**Maximum**	2.8

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.146	0.164	0.195	0.955
Box:	0.495	0.309	0.314	3.26

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.155	0.0159	0.0554

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00137	0.00685
Box:	0.255	0.122	0.294

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.182	0.00233	0.00685
Box:	0.221	0.102	0.296

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0129	**Sash Leakage Area / Face Area**	0.604
Box Leakage / Hood Flow	0.000107	**Box Leakage Area / Box Surface Area**	0.368

Casename run045

Date 8/31/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off square 24" layout SQ B.1. Person 4 inches from hood Hood -783, Trunk exhaust -413 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	7	Mwords	**Grid Dimensions:**	**X**	59	**Y**	58	**Z**	41	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.455	Standard Deviation	0.252	Maximum	1.11

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.448	1.47	0.445	1.47
Box:	0.949	3.3	0.961	2.97

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.682	Standard Deviation	0.961	Maximum	10.2

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.239	0.21	0.291	0.977
Box:	0.339	0.268	0.467	3.37

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0303	0.000685	0.0216

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00137	0.00685
Box:	0.13	0.0721	0.275

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.192	0.0026	0.00685
Box:	0.154	0.0897	0.326

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0159	**Sash Leakage Area / Face Area**	0.588
Box Leakage / Hood Flow	0.000154	**Box Leakage Area / Box Surface Area**	0.426

Casename run046

Date 8/31/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off square 24" layout SQ B.1. Person 6 inches from hood Hood -783 cfm, trunk exhaust, -413 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	7	Mwords	**Grid Dimensions:**	**X**	59	**Y**	58	**Z**	41	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.461 **Standard Deviation** 0.255 **Maximum** 1.11

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.393	1.47	0.403	1.47
Box:	0.932	2.91	0.931	2.64

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.646 **Standard Deviation** 0.971 **Maximum** 13.6

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.163	0.151	0.254	0.988
Box:	0.354	0.268	0.448	3.35

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0442	0.000821	0.0218

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00137	0.00685
Box:	0.144	0.0844	0.273

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.192	0.0026	0.00685
Box:	0.139	0.0775	0.309

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0159	**Sash Leakage Area / Face Area**	0.58
Box Leakage / Hood Flow	0.000149	**Box Leakage Area / Box Surface Area**	0.417

Casename run047

Date 8/31/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
6 off Laminar / downflow 48" x 12" layout LAM A.1 Hood -783 cfm, Trunk exhaust -413 cfm, door crack 100 cfm

Specialist Devices	Downflow diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**		no			
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	49	**Y**	44	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.424	Standard Deviation	0.302	Maximum	1.52

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.336	0.42	0.341	0.386
Box:	0.778	1.85	0.818	1.95

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.636	Standard Deviation	0.419	Maximum	1.51

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0435	0.0218	0.232	0.0919
Box:	0.279	0.185	0.372	3.56

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0703	0.00375	0.0184

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.17	0.0412	0.155

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.162	0.0582	0.197

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00444	**Sash Leakage Area / Face Area**	0.521
Box Leakage / Hood Flow	0.000201	**Box Leakage Area / Box Surface Area**	0.683

Casename run048

Date 8/31/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
4 off Laminar / Downflow 48" x 24" layout LAM B.1 Hood -783 cfm, Trunk exhaust -413 cfm, door crack 100 cfm

Specialist Devices	Downflow diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**		no			
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5 Mwords	**Grid Dimensions:**	**X**	49	**Y**	42	**Z**	34		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.365 **Standard Deviation** 0.269 **Maximum** 1.48

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.35	0.415	0.354	0.394
Box:	0.778	2.02	0.813	1.96

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.63 **Standard Deviation** 0.399 **Maximum** 1.4

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0325	0.0137	0.295	0.129
Box:	0.193	0.14	0.456	5.02

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0357	0.000901	0.00975

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.136	0.0229	0.128

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.153	0.0377	0.17

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00455	**Sash Leakage Area / Face Area**	0.512
Box Leakage / Hood Flow	0.000233	**Box Leakage Area / Box Surface Area**	0.754

Casename run049

Date 8/31/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off Radial 48" x 24" layout TAD A.1 Hood -783 cfm, Trunk exhaust -413 cfm, door crack 100 cfm

Specialist Devices	TAD			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no				
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	7	Mwords	**Grid Dimensions:**	**X**	52	**Y**	57	**Z**	39	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.315	Standard Deviation	0.263	Maximum	1.31

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.336	0.393	0.339	0.424
Box:	0.741	1.75	0.759	2.04

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.642	Standard Deviation	0.438	Maximum	1.85

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0271	0.0357	0.244	1.11
Box:	0.218	0.153	0.311	6.8

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.00482	0.0000837	0.00515

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.105	0.0256	0.145

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.117	0.0327	0.161

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00965	**Sash Leakage Area / Face Area**	0.497
Box Leakage / Hood Flow	0.000356	**Box Leakage Area / Box Surface Area**	0.642

Casename run049c

Date 8/31/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
As run049: Person placed 4 inches in front of hood, lights and ductwork recessed into ceiling

Specialist Devices	TAD			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	7	Mwords	**Grid Dimensions:**	**X**	52	**Y**	57	**Z**	39	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.414	**Standard Deviation**	0.243	**Maximum**	1.06

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.43	1.46	0.431	1.46
Box:	0.893	3.01	0.887	2.76

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.559	**Standard Deviation**	0.644	**Maximum**	5.1

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.237	0.216	0.215	0.962
Box:	0.326	0.24	0.307	3.1

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.05	0.000584	0.00523

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00137	0.00685
Box:	0.15	0.0713	0.273

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.187	0.00248	0.00685
Box:	0.152	0.0696	0.287

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.014	**Sash Leakage Area / Face Area**	0.593
Box Leakage / Hood Flow	0.000126	**Box Leakage Area / Box Surface Area**	0.425

Casename run050

Date 8/31/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off Radial 24" x 24" - layout TAD B.1 Hood -783 cfm, trunk exhaust -413 cfm, door crack 100 cfm

Specialist Devices	TAD			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no				
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	7	Mwords	**Grid Dimensions:**	**X**	56	**Y**	57	**Z**	39	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.363	Standard Deviation	0.302	Maximum	1.5

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.327	0.389	0.333	0.422
Box:	0.759	1.91	0.777	2.18

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.643	Standard Deviation	0.454	Maximum	1.65

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0303	0.0331	0.216	1.08
Box:	0.27	0.18	0.254	5.7

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0587	0.00262	0.0177

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.159	0.0388	0.173

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.148	0.0477	0.175

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00969	**Sash Leakage Area / Face Area**	0.504
Box Leakage / Hood Flow	0.000334	**Box Leakage Area / Box Surface Area**	0.646

Casename run050c

Date 8/31/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
As run050; Person placed 4 inches in front of hood, lights and ductwork recessed into ceiling

Specialist Devices	TAD			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	7	Mwords	**Grid Dimensions:**	**X**	56	**Y**	57	**Z**	39	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.461 **Standard Deviation** 0.307 **Maximum** 1.41

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.433	1.46	0.439	1.46
Box:	0.966	3.15	0.942	2.95

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.577 **Standard Deviation** 0.687 **Maximum** 5.3

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.228	0.213	0.246	0.967
Box:	0.403	0.263	0.384	3.24

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0613	0.00192	0.0145

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00137	0.00685
Box:	0.161	0.0856	0.318

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.175	0.00233	0.00685
Box:	0.16	0.0986	0.332

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0142	**Sash Leakage Area / Face Area**	0.602
Box Leakage / Hood Flow	0.000148	**Box Leakage Area / Box Surface Area**	0.452

Casename run051

Date 8/31/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
4 off Radial 24" x 24" layout TAD C.1a Hood -783 cfm, Trunk exhaust -413 cfm, door crack 100 cfm

Specialist Devices	TAD			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no				
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	7	Mwords	**Grid Dimensions:**	**X**	56	**Y**	56	**Z**	39	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.364	Standard Deviation	0.304	Maximum	1.74

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.369	0.436	0.378	0.445
Box:	0.841	2.33	0.867	2.26

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.65	Standard Deviation	0.449	Maximum	1.69

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0298	0.0254	0.368	1.16
Box:	0.263	0.161	0.521	10.3

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0505	0.00165	0.0142

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.15	0.0322	0.158

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.176	0.0623	0.241

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0109	**Sash Leakage Area / Face Area**	0.499
Box Leakage / Hood Flow	0.000767	**Box Leakage Area / Box Surface Area**	0.624

Casename run052

Date 8/31/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F, 12.8°C, toatl heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
4 off square layout SQ A.1 .Decrease jet thickness - initial jet velocity doubled. Hood -783 cfm, Exhaust -413 cfm, Crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	57	**Y**	48	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.438	**Standard Deviation**	0.361	**Maximum**	1.58

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.305	0.382	0.309	0.382
Box:	0.755	1.94	0.802	1.81

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.641	**Standard Deviation**	0.446	**Maximum**	1.46

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0603	0.0957	0.159	0.0614
Box:	0.397	0.286	0.269	2.8

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0788	0.00502	0.0254

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.179	0.0546	0.18

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.167	0.0679	0.197

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00288	**Sash Leakage Area / Face Area**	0.449
Box Leakage / Hood Flow	0.000082	**Box Leakage Area / Box Surface Area**	0.592

Casename run053

Date 8/31/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
4 off square layout SQ A.1. Increase jet thickness - initial jet velocity halved. Hood -783 cfm, Exhaust -413 cfm, Crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	57	**Y**	48	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.36	**Standard Deviation**	0.228	**Maximum**	1

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.299	0.372	0.311	0.362
Box:	0.713	2.25	0.717	2.08

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.653	**Standard Deviation**	0.454	**Maximum**	1.48

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0513	0.0225	0.151	0.0547
Box:	0.294	0.143	0.21	1.57

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0136	0.000224	0.00322

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.114	0.0338	0.156

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.111	0.0368	0.156

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00379	**Sash Leakage Area / Face Area**	0.538
Box Leakage / Hood Flow	0.000129	**Box Leakage Area / Box Surface Area**	0.608

Casename run054

Date 8/31/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
4 off square - layout SQ A.1 -Bulkhead Hood -783 cfm, trunk exhaust -413 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser				
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	53	**Y**	48	**Z**	34

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.497	**Standard Deviation**	0.42	**Maximum**	2

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.306	0.399	0.31	0.371
Box:	0.794	2.4	0.87	2.17

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.627	**Standard Deviation**	0.417	**Maximum**	1.5

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0541	0.087	0.181	0.424
Box:	0.363	0.279	0.288	5.99

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.225	0.0285	0.0493

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.325	0.0706	0.129

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.302	0.0768	0.152

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00516	**Sash Leakage Area / Face Area**	0.521
Box Leakage / Hood Flow	0.000145	**Box Leakage Area / Box Surface Area**	0.512

Casename run054b

Date 4/18/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
4 off perforated (horizontal) - layout PERF A.1 -Bulkhead Hood -783 cfm, trunk exhaust -413 cfm, door crack 100 cfm

Specialist Devices	Perforated diff		Fume hood		Ceiling diffuser						
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	53	**Y**	48	**Z**	34

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.579 **Standard Deviation** 0.491 **Maximum** 2.8

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.322	0.407	0.324	0.396
Box:	0.808	2.42	0.905	1.71

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.623 **Standard Deviation** 0.414 **Maximum** 1.34

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0602	0.0706	0.187	0.0478
Box:	0.408	0.334	0.308	2.12

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.229	0.0264	0.0498

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.329	0.0797	0.19

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.302	0.0855	0.197

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00414	**Sash Leakage Area / Face Area**	0.484
Box Leakage / Hood Flow	0.000121	**Box Leakage Area / Box Surface Area**	0.547

Casename run055

Date 8/31/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
4 off square layout SQ A.1. Hood position 2 - rearrange lab layout. Hood -783 cfm, Trunk exhaust -413 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no				
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	57	**Y**	50	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.389	**Standard Deviation**	0.332	**Maximum**	1.74

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.267	0.39	0.273	0.326
Box:	0.674	2.27	0.715	2.12

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.632	**Standard Deviation**	0.42	**Maximum**	1.47

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0589	0.107	0.0914	0.0613
Box:	0.409	0.253	0.117	0.725

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.063	0.00282	0.0167

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.163	0.0492	0.195

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.175	0.0387	0.167

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00219	**Sash Leakage Area / Face Area**	0.567
Box Leakage / Hood Flow	0.000027	**Box Leakage Area / Box Surface Area**	0.569

Casename run055b

Date 4/18/96

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
4 off perf horizontal layout PERF A.1. Hood position 2 - rearrangelab layout. Hood -783 cfm, Trunk exhaust -413 cfm, door

Specialist Devices	Perforated diff		Fume hood		Ceiling diffuser						
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	57	**Y**	50	**Z**	34

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	1.01	**Standard Deviation**	-999	**Maximum**	1

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.278	0.433	1.03	1.06
Box:	0.871	2.71	1.15	1.56

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.614	**Standard Deviation**	0.355	**Maximum**	1.16

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0529	0.954	0.149	0.0506
Box:	0.711	1.01	0.198	1.73

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.292	0.0635	0.0972

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.392	0.155	0.241

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.357	0.15	0.26

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00361	**Sash Leakage Area / Face Area**	0.467
Box Leakage / Hood Flow	0.000187	**Box Leakage Area / Box Surface Area**	0.284

Casename run056

Date 8/31/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
4 off square layout SQ A.1. Move hood to position 3 - rearrange lab layout. Hood -783 cfm, Trunk exhaust -413 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	10 Mwords	**Grid Dimensions:**	**X**	70	**Y**	62	**Z**	41		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.678 **Standard Deviation** 0.361 **Maximum** 2.02

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.351	0.476	0.36	0.508
Box:	0.858	2.24	0.96	2.02

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.64 **Standard Deviation** 0.437 **Maximum** 1.63

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0381	0.09	0.282	1.12
Box:	0.551	0.417	0.484	12.3

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.171	0.0234	0.0685

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.271	0.0829	0.201

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.313	0.107	0.231

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00987	**Sash Leakage Area / Face Area**	0.506
Box Leakage / Hood Flow	0.000644	**Box Leakage Area / Box Surface Area**	0.264

Casename run056b

Date 4/18/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
4 off perf hori layout PERF A.1. Move hood to position 3 -rearrange lab layout. Hood -783 cfm, Trunk exhaust -413 cfm, door

Specialist Devices	Perforated diff			Fume hood			Ceiling diffuser				
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no			
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	10 Mwords	**Grid Dimensions:**	**X**	70	**Y**	62	**Z**	41	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	1.14	Standard Deviation	-999	Maximum	1

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.326	0.427	1.05	1.07
Box:	0.72	2.1	1.11	1.54

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.634	Standard Deviation	0.434	Maximum	1.52

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0374	0.973	0.212	0.0693
Box:	0.399	1.14	0.407	3.93

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0388	0.0026	0.0208

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.139	0.0345	0.149

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.155	0.0508	0.176

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00404	**Sash Leakage Area / Face Area**	0.503
Box Leakage / Hood Flow	0.000151	**Box Leakage Area / Box Surface Area**	0.587

Casename run057

Date 8/31/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm(100%), Supply 1645 cfm (13.6 ACH), Tsup 55°F, 12.8°C, total heat load 12 W/ft² (equip 9.7 W/ft²)

Parametric Variation
4 off square - layout SQ A.1 Hood -783 cfm, trunk exhaust -762 cfm, door crack 100 cfm

Specialist Devices	Square diffuser		Fume hood		Ceiling diffuser						
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	53	**Y**	48	**Z**	34

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.543 **Standard Deviation** 0.495 **Maximum** 2.44

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.287	0.403	0.301	0.384
Box:	0.811	2.3	0.911	2.17

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.621 **Standard Deviation** 0.414 **Maximum** 1.32

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0569	0.11	0.18	0.391
Box:	0.441	0.346	0.278	6.35

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.201	0.0302	0.0664

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.301	0.0861	0.171

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.284	0.0981	0.188

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00442	**Sash Leakage Area / Face Area**	0.503
Box Leakage / Hood Flow	0.000131	**Box Leakage Area / Box Surface Area**	0.473

Casename run058

Date 8/31/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 2190 cfm (18.1 ACH), Tsup 63.5°F, 17.5°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
4 off square layout SQ A.1 Hood -783 cfm, trunk exhaust -762 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser				
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5 Mwords	**Grid Dimensions:**	**X**	53	**Y**	48	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.516	Standard Deviation	0.499	Maximum	2.76

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.288	0.409	0.293	0.376
Box:	0.811	2.31	0.851	2.28

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.66	Standard Deviation	0.459	Maximum	1.59

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0572	0.111	0.0724	0.379
Box:	0.493	0.333	0.24	4.93

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0959	0.00774	0.0419

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.196	0.0724	0.223

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.208	0.0827	0.24

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00432	**Sash Leakage Area / Face Area**	0.519
Box Leakage / Hood Flow	0.000109	**Box Leakage Area / Box Surface Area**	0.624

Casename run060

Date 8/31/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description

14 off floor grilles - layout DISP 1 Hood -783 cfm, Ceiling extract 1506 cfm, door crack 100 cfm

Specialist Devices	Displacement			Fume hood			Floor diffuser				
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5 Mwords	**Grid Dimensions:**	**X**	51	**Y**	36	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean 0.291 **Standard Deviation** 0.207 **Maximum** 1.03

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.255	0.392	0.251	0.338
Box:	0.544	1.59	0.548	1.65

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean 0.599 **Standard Deviation** 0.373 **Maximum** 1.33

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0551	0.0394	0.142	0.0856
Box:	0.165	0.117	0.151	0.618

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0	0	0

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0603	0.0141	0.117

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.033	0.00178	0.0207

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00272	**Sash Leakage Area / Face Area**	0.548
Box Leakage / Hood Flow	0.000032	**Box Leakage Area / Box Surface Area**	0.559

Casename run059

Date 8/31/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description

Large laboratory (33 x 22), hood 100 fpm (100%), Supply 2190 cfm (18.1 ACH), Tsup 63.5°F 17.5°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation

Standing displacement units (4 off) DISP 2 Hood -783 cfm, Ceiling extracts -1506 cfm, door crack 100 cfm

Specialist Devices	Displacement			Fume hood								
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	48	**Y**	46	**Z**	35	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean 0.298 **Standard Deviation** 0.191 **Maximum** 0.939

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.271	0.376	0.275	0.377
Box:	0.564	1.89	0.569	1.89

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean 0.622 **Standard Deviation** 0.394 **Maximum** 1.37

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0514	0.0544	0.114	1.75
Box:	0.194	0.114	0.139	2.92

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0	0	0

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0786	0.0139	0.105

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0578	0.00537	0.056

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0095	**Sash Leakage Area / Face Area**	0.44
Box Leakage / Hood Flow	0.000145	**Box Leakage Area / Box Surface Area**	0.546

Casename run061

Date 8/31/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
4 off square - layout SQ A.2a Hood -783, Trunk exhaust -413, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**		no			
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	56	**Y**	48	**Z**	35	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.414	**Standard Deviation**	0.322	**Maximum**	1.73

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.327	0.413	0.33	0.409
Box:	0.754	1.8	0.795	1.82

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.655	**Standard Deviation**	0.475	**Maximum**	1.67

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0443	0.046	0.203	0.065
Box:	0.273	0.178	0.304	2.29

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0702	0.00305	0.0171

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.17	0.0356	0.139

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.142	0.0394	0.171

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0041	**Sash Leakage Area / Face Area**	0.513
Box Leakage / Hood Flow	0.00012	**Box Leakage Area / Box Surface Area**	0.583

Casename run061b

Date 4/18/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
4 off perf hori - layout PERF A.2a Hood -783, Trunk exhaust -413, door crack 100 cfm

Specialist Devices	Perforated diff			Fume hood		Ceiling diffuser						
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5 Mwords	**Grid Dimensions:**	**X**	56	**Y**	48	**Z**	35		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.41	Standard Deviation	0.328	Maximum	1.54

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.351	0.438	0.349	0.403
Box:	0.798	1.65	0.83	1.73

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.631	Standard Deviation	0.414	Maximum	1.59

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0398	0.0244	0.281	0.102
Box:	0.251	0.198	0.439	5.35

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0155	0.00162	0.0266

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.115	0.0379	0.128

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.138	0.0575	0.176

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00479	**Sash Leakage Area / Face Area**	0.507
Box Leakage / Hood Flow	0.000234	**Box Leakage Area / Box Surface Area**	0.706

Casename run062

Date 8/31/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description

Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation

4 off square layout SQ A.2b (part towards wall blanked) Hood -783 cfm, Trunk exhaust -413 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**		no			
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5 Mwords	**Grid Dimensions:**	**X**	56	**Y**	48	**Z**	35		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean 0.4 **Standard Deviation** 0.307 **Maximum** 1.67

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.343	0.411	0.34	0.414
Box:	0.786	1.71	0.822	1.78

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean 0.649 **Standard Deviation** 0.443 **Maximum** 1.59

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0248	0.0328	0.244	0.0828
Box:	0.263	0.181	0.403	4.66

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0555	0.00506	0.0326

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.156	0.0381	0.151

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.159	0.0573	0.176

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00437	**Sash Leakage Area / Face Area**	0.489
Box Leakage / Hood Flow	0.000175	**Box Leakage Area / Box Surface Area**	0.619

Casename run063

Date 8/31/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description

Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation

4 off square layout SQ A.3 Hood -783 cfm, Trunk exhaust -413 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5 Mwords	**Grid Dimensions:**	**X**	55	**Y**	48	**Z**	34		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean 0.399 **Standard Deviation** 0.274 **Maximum** 1.49

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.308	0.368	0.303	0.385
Box:	0.787	2.01	0.819	2

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean 0.662 **Standard Deviation** 0.48 **Maximum** 1.52

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0505	0.0602	0.167	0.43
Box:	0.376	0.21	0.315	9.87

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.102	0.0143	0.0535

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.202	0.0621	0.155

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.232	0.0778	0.198

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0048	**Sash Leakage Area / Face Area**	0.524
Box Leakage / Hood Flow	0.000176	**Box Leakage Area / Box Surface Area**	0.423

Casename run063b

Date 4/18/96

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description

Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation

4 off perf hori layout PERF SQ A.3 Hood -783 cfm, Trunk exhaust -413 cfm, door crack 100 cfm

Specialist Devices	Perforated diff			Fume hood		Ceiling diffuser						
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5 Mwords	**Grid Dimensions:**	**X**	55	**Y**	48	**Z**	34		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean 0.572 **Standard Deviation** 0.399 **Maximum** 2.44

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.336	0.416	0.345	0.449
Box:	0.871	2.2	0.922	1.91

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean 0.652 **Standard Deviation** 0.457 **Maximum** 1.58

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.04	0.0929	0.249	0.0854
Box:	0.433	0.342	0.416	5.9

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.17	0.0156	0.0597

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.27	0.0706	0.207

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.286	0.0875	0.224

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0036	**Sash Leakage Area / Face Area**	0.505
Box Leakage / Hood Flow	0.00021	**Box Leakage Area / Box Surface Area**	0.376

Casename run065

Date 8/31/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off square layout SQ B.2 Hood -783 cfm, Trunk exhaust -413 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	7	Mwords	**Grid Dimensions:**	**X**	59	**Y**	54	**Z**	41	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.267 **Standard Deviation** 0.185 **Maximum** 0.826

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.331	0.393	0.331	0.401
Box:	0.714	1.98	0.709	2

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.646 **Standard Deviation** 0.448 **Maximum** 1.6

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0334	0.0171	0.216	1.09
Box:	0.232	0.0805	0.257	4.58

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0	0	0

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0926	0.0265	0.152

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0931	0.0314	0.165

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0101	**Sash Leakage Area / Face Area**	0.483
Box Leakage / Hood Flow	0.000321	**Box Leakage Area / Box Surface Area**	0.572

Casename run064

Date 8/31/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off square layout SQ B.3 (Part of diffuser towards hood blanked) Hood -783 cfm, Trunk exhaust -413 cfm, Door crack 100 cfm

Specialist Devices	Square diffuser		Fume hood		Ceiling diffuser						
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	7	Mwords	**Grid Dimensions:**	**X**	58	**Y**	57	**Z**	41

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.242	Standard Deviation	0.167	Maximum	0.904

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.362	0.439	0.363	0.458
Box:	0.781	1.83	0.787	1.86

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.648	Standard Deviation	0.459	Maximum	1.72

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0337	0.0151	0.341	1.14
Box:	0.179	0.0607	0.459	6.96

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0	0	0

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0782	0.0143	0.107

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0921	0.0254	0.159

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0111	**Sash Leakage Area / Face Area**	0.523
Box Leakage / Hood Flow	0.000369	**Box Leakage Area / Box Surface Area**	0.548

Casename run067

Date 8/31/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
6 off lamianr / downflow layout LAM A.2 Hood -783, Trunk exhaust -413, door crack 100 cfm

Specialist Devices	Downflow diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**		no			
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	50	**Y**	43	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.389	**Standard Deviation**	0.275	**Maximum**	1.16

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.372	0.46	0.37	0.457
Box:	0.827	1.99	0.854	1.99

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.656	**Standard Deviation**	0.433	**Maximum**	1.36

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0244	0.0346	0.357	0.138
Box:	0.255	0.189	0.576	9.57

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0605	0.00274	0.00975

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.161	0.0341	0.136

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.214	0.0711	0.222

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00484	**Sash Leakage Area / Face Area**	0.541
Box Leakage / Hood Flow	0.000288	**Box Leakage Area / Box Surface Area**	0.695

Casename run066

Date 8/31/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
4 off laminar / downflow layout LAM B.2 Hood -783 cfm, Trunk exhaust -413 cfm, door crack 100 cfm

Specialist Devices	Downflow diffuser			Fume hood			Ceiling diffuser				
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**		no		
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5 Mwords	**Grid Dimensions:**	**X**	49	**Y**	42	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.363 **Standard Deviation** 0.258 **Maximum** 1.43

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.326	0.4	0.329	0.381
Box:	0.723	1.95	0.754	1.9

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.631 **Standard Deviation** 0.397 **Maximum** 1.33

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0329	0.0121	0.199	0.088
Box:	0.203	0.14	0.314	2.77

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0362	0.000952	0.00975

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.136	0.0244	0.14

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.148	0.0327	0.156

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00395	**Sash Leakage Area / Face Area**	0.59
Box Leakage / Hood Flow	0.000166	**Box Leakage Area / Box Surface Area**	0.743

Casename run068

Date 8/31/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
4 off laminar / downflow layout LAM B.3 Hood -783 cfm, Trunk exhaust -413 cfm, door crack 100 cfm

Specialist Devices	Downflow diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**		no			
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5 Mwords	**Grid Dimensions:**	**X**	51	**Y**	42	**Z**	34		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.338	Standard Deviation	0.229	Maximum	1.28

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.388	0.432	0.387	0.447
Box:	0.858	1.69	0.881	1.87

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.66	Standard Deviation	0.452	Maximum	1.59

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0283	0.0176	0.429	0.178
Box:	0.186	0.113	0.67	11

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.032	0.00098	0.00686

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.132	0.021	0.124

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.168	0.0516	0.25

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00563	**Sash Leakage Area / Face Area**	0.502
Box Leakage / Hood Flow	0.000329	**Box Leakage Area / Box Surface Area**	0.638

Casename run069

Date 8/31/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off radial - layout TAD A.2 Hood -783 cfm, Trunk exhaust -413 cfm, door crack 100 cfm

Specialist Devices	TAD			Fume hood			Ceiling diffuser				
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	7 Mwords	**Grid Dimensions:**	**X**	52	**Y**	56	**Z**	39	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.277 **Standard Deviation** 0.191 **Maximum** 1.21

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.363	0.43	0.363	0.438
Box:	0.789	1.58	0.804	1.81

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.636 **Standard Deviation** 0.429 **Maximum** 1.68

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0308	0.021	0.34	1.15
Box:	0.185	0.0764	0.487	8.26

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0185	0.000234	0.00313

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.119	0.0201	0.119

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.121	0.0304	0.192

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0105	**Sash Leakage Area / Face Area**	0.516
Box Leakage / Hood Flow	0.000421	**Box Leakage Area / Box Surface Area**	0.573

Casename run069c

Date 8/31/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
As run069; Person placed 4 inches in front of hood, lights and ductwork recessed into ceiling

Specialist Devices	TAD			Fume hood		Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	7 Mwords	**Grid Dimensions:**	**X**	52	**Y**	56	**Z**	39	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	Standard Deviation	Maximum
0.419	0.219	1.1

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.459	1.47	0.459	1.47
Box:	0.992	2.86	1	2.8

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	Standard Deviation	Maximum
0.746	1.74	18.4

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.232	0.216	0.354	1
Box:	0.292	0.253	0.619	3.63

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0247	0.000304	0.00322

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00137	0.00685
Box:	0.125	0.0685	0.254

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.2	0.00264	0.00685
Box:	0.16	0.0997	0.366

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0178	**Sash Leakage Area / Face Area**	0.596
Box Leakage / Hood Flow	0.000227	**Box Leakage Area / Box Surface Area**	0.514

Casename run070

Date 8/31/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off radial layout TAD A.3 Hood -783 cfm, Trunk exhaust -413 cfm, door crack 100 cfm

Specialist Devices	TAD			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no				
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	7	Mwords	**Grid Dimensions:**	**X**	52	**Y**	56	**Z**	39	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.265 **Standard Deviation** 0.174 **Maximum** 0.962

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.386	0.474	0.385	0.493
Box:	0.861	1.75	0.877	2.05

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.635 **Standard Deviation** 0.442 **Maximum** 1.64

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0278	0.0257	0.419	1.16
Box:	0.187	0.0771	0.641	12.8

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0524	0.00104	0.0133

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.152	0.0223	0.111

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.189	0.0622	0.245

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0118	**Sash Leakage Area / Face Area**	0.511
Box Leakage / Hood Flow	0.000495	**Box Leakage Area / Box Surface Area**	0.518

Casename run070c

Date 8/31/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
As run070; Person placed 4 inches in front of hood, lights and ductwork recessed into ceiling

Specialist Devices	TAD			Fume hood		Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	7 Mwords	**Grid Dimensions:**	**X**	52	**Y**	56	**Z**	39	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	Standard Deviation	Maximum
0.445	0.218	0.936

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.47	1.5	0.473	1.5
Box:	1.06	2.92	1.09	2.89

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	Standard Deviation	Maximum
0.634	0.827	6.58

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.224	0.216	0.415	1.02
Box:	0.306	0.286	0.799	5.49

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.053	0.000604	0.00572

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00137	0.00685
Box:	0.153	0.0716	0.256

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.244	0.00332	0.00685
Box:	0.222	0.144	0.416

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.02	**Sash Leakage Area / Face Area**	0.598
Box Leakage / Hood Flow	0.000373	**Box Leakage Area / Box Surface Area**	0.39

Casename run071

Date 8/31/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off radial layout TAD B.2 Hood -783 cfm, trunk exhaust -413 cfm, door crack 100 cfm

Specialist Devices	TAD			Fume hood			Ceiling diffuser				
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**		no		
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	7 Mwords	**Grid Dimensions:**	**X**	56	**Y**	56	**Z**	39	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.335 **Standard Deviation** 0.267 **Maximum** 1.61

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.382	0.46	0.383	0.467
Box:	0.868	1.86	0.897	1.94

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.642 **Standard Deviation** 0.444 **Maximum** 1.67

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.03	0.0256	0.411	1.17
Box:	0.22	0.122	0.629	12.7

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0815	0.00326	0.0163

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.182	0.0303	0.131

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.215	0.0583	0.266

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0114	**Sash Leakage Area / Face Area**	0.533
Box Leakage / Hood Flow	0.000584	**Box Leakage Area / Box Surface Area**	0.564

Casename run072

Date 8/31/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description

Large laboratory (33 x 22), hood 100 fpm (100%) Supply 1097 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation

Specialist Devices	TAD			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**		no			
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	7	Mwords	**Grid Dimensions:**	**X**	56	**Y**	56	**Z**	39	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.453	**Standard Deviation**	0.257	**Maximum**	1.48

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.465	1.47	0.469	1.47
Box:	1.05	2.84	1.06	2.9

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.639	**Standard Deviation**	1.08	**Maximum**	10.9

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.227	0.216	0.393	1.01
Box:	0.331	0.268	0.736	4.06

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0767	0.00137	0.0094

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00137	0.00685
Box:	0.177	0.0754	0.277

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.209	0.00272	0.00685
Box:	0.217	0.134	0.446

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0186	**Sash Leakage Area / Face Area**	0.596
Box Leakage / Hood Flow	0.000268	**Box Leakage Area / Box Surface Area**	0.471

Casename run071c

Date 8/31/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description

Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation

As run071, Person TAD B 3 Hood 783 cfm, 4 Inlet exhaust 413 cfm, door crack 100 cfm
As run071, Person placed 4 inches from hood, lights and ductwork recessed into ceiling

Specialist Devices	TAD			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	7	Mwords	**Grid Dimensions:**	**X**	54	**Y**	56	**Z**	39	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean 0.381 **Standard Deviation** 0.234 **Maximum** 1.28

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.41	0.503	0.408	0.515
Box:	0.941	2.04	0.974	1.82

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean 0.628 **Standard Deviation** 0.407 **Maximum** 1.4

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0316	0.0399	0.509	1.22
Box:	0.269	0.166	0.831	25.4

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.118	0.00785	0.0273

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.218	0.0406	0.124

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.269	0.1	0.302

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0129	**Sash Leakage Area / Face Area**	0.436
Box Leakage / Hood Flow	0.00101	**Box Leakage Area / Box Surface Area**	0.589

Casename run073

Date 8/31/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description

Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation

Specialist Devices	TAD			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**		no			
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	7	Mwords	**Grid Dimensions:**	**X**	54	**Y**	56	**Z**	39	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean 0.479 **Standard Deviation** 0.245 **Maximum** 1.18

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.482	1.49	0.486	1.49
Box:	1.1	2.72	1.13	2.74

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean 0.59 **Standard Deviation** 0.644 **Maximum** 4.22

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.229	0.226	0.45	1.03
Box:	0.353	0.295	0.888	6.13

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0871	0.00366	0.0284

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00137	0.00685
Box:	0.187	0.0771	0.253

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.231	0.0031	0.00685
Box:	0.248	0.164	0.446

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0205	**Sash Leakage Area / Face Area**	0.598
Box Leakage / Hood Flow	0.000455	**Box Leakage Area / Box Surface Area**	0.454

Casename run072c

Date 8/31/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description

Large laboratory (33 x 22), hood 100 fpm (100%) Supply 1097 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation

As run072: Person TAD 3 inches in front of hood, lights and ceiling recessed into ceiling

Specialist Devices	TAD			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**	no				
Concentration	From hood		**Turbulence**	ke model		**Special**						
Dimensionality	3d Steady	**A-Array Size**	7	Mwords	**Grid Dimensions:**		**X**	58	**Y**	55	**Z**	39

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean 0.336 **Standard Deviation** 0.205 **Maximum** 0.852

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.381	0.519	0.377	0.518
Box:	0.885	1.94	0.918	2.07

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean 0.634 **Standard Deviation** 0.437 **Maximum** 1.43

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0269	0.0346	0.385	1.13
Box:	0.258	0.16	0.659	14.8

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0816	0.00459	0.0299

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.182	0.0419	0.145

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.254	0.105	0.266

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0119	**Sash Leakage Area / Face Area**	0.524
Box Leakage / Hood Flow	0.000664	**Box Leakage Area / Box Surface Area**	0.454

Casename run073c

Date 8/31/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
As run073; Person placed 4 inches in front of hood, lights and ductwork recessed into ceiling

Specialist Devices	TAD			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no				
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	7	Mwords	**Grid Dimensions:**	**X**	58	**Y**	55	**Z**	39	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.438	Standard Deviation	0.246	Maximum	1.12

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.469	1.49	0.469	1.49
Box:	1.07	2.81	1.07	2.76

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.608	Standard Deviation	0.711	Maximum	4.96

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.225	0.219	0.391	1.01
Box:	0.366	0.238	0.792	5.06

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.167	0.0175	0.0443

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00137	0.00685
Box:	0.267	0.0899	0.225

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.236	0.00318	0.00685
Box:	0.311	0.161	0.364

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0189	**Sash Leakage Area / Face Area**	0.617
Box Leakage / Hood Flow	0.000331	**Box Leakage Area / Box Surface Area**	0.422

Casename run074

Date 8/31/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm(100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
4 off radial layout TAD C.1b Hood -783 cfm, trunk exhaust -413 cfm, door crack 100 cfm

Specialist Devices	TAD			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	7	Mwords	**Grid Dimensions:**	**X**	60	**Y**	55	**Z**	39	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.33 **Standard Deviation** 0.258 **Maximum** 1.4

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.36	0.418	0.367	0.43
Box:	0.807	2.16	0.823	2.14

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.648 **Standard Deviation** 0.443 **Maximum** 1.49

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0282	0.0213	0.334	1.14
Box:	0.252	0.136	0.465	8.31

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.014	0.000178	0.00515

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.114	0.0292	0.155

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.13	0.0506	0.222

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0108	**Sash Leakage Area / Face Area**	0.505
Box Leakage / Hood Flow	0.000619	**Box Leakage Area / Box Surface Area**	0.701

Casename run074c

Date 8/31/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm(100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
As run074; Person placed 4 inches in front of hood, lights and ductwork recessed into ceiling

Specialist Devices	TAD			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	7 Mwords	**Grid Dimensions:**	**X**	60	**Y**	55	**Z**	39		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.45	Standard Deviation	0.284	Maximum	1.38

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.465	1.46	0.464	1.46
Box:	1.02	3.27	1.02	2.97

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.55	Standard Deviation	0.552	Maximum	2.96

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.231	0.207	0.378	1.01
Box:	0.346	0.261	0.653	4.08

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0378	0.000797	0.0127

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00137	0.00685
Box:	0.138	0.0742	0.272

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.186	0.00251	0.00685
Box:	0.149	0.121	0.391

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0174	**Sash Leakage Area / Face Area**	0.597
Box Leakage / Hood Flow	0.000309	**Box Leakage Area / Box Surface Area**	0.522

Casename run075

Date 8/31/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
4 off radial - layout TAD C.2 Hood -783 cfm, trunk exhaust -413 cfm, door crack 100 cfm

Specialist Devices	TAD		Fume hood		Ceiling diffuser						
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	7 Mwords	**Grid Dimensions:**	**X**	57	**Y**	56	**Z**	39	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.344 **Standard Deviation** 0.237 **Maximum** 1.52

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.399	0.466	0.399	0.481
Box:	0.91	2.01	0.932	1.92

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.642 **Standard Deviation** 0.449 **Maximum** 1.73

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0275	0.0235	0.472	1.19
Box:	0.244	0.118	0.728	15.5

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.123	0.00568	0.0257

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.223	0.0369	0.128

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.246	0.0793	0.278

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0124	**Sash Leakage Area / Face Area**	0.504
Box Leakage / Hood Flow	0.000669	**Box Leakage Area / Box Surface Area**	0.527

Casename run075c

Date 8/31/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
As run075; Person placed 4 inches in front of hood, lights and ductwork recessed into ceiling

Specialist Devices	TAD			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	7 Mwords	**Grid Dimensions:**	**X**	57	**Y**	56	**Z**	39		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.477	Standard Deviation	0.248	Maximum	1.28

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.471	1.48	0.475	1.48
Box:	1.08	3.03	1.1	2.78

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.522	Standard Deviation	0.523	Maximum	2.95

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.222	0.214	0.42	1.02
Box:	0.349	0.302	0.79	4.77

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0866	0.00221	0.02

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00137	0.00685
Box:	0.187	0.0791	0.265

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.222	0.00303	0.00685
Box:	0.223	0.152	0.463

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.02	**Sash Leakage Area / Face Area**	0.597
Box Leakage / Hood Flow	0.000347	**Box Leakage Area / Box Surface Area**	0.459

Casename run076

Date 8/31/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
4 off square - layout SQ A.1 Hood -783 cfm, extract -413, crack 1 36 cfm, crack 2 32 cfm, crack 3 28 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser				
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5 Mwords	**Grid Dimensions:**	**X**	57	**Y**	48	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.423 **Standard Deviation** 0.277 **Maximum** 1.24

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.297	0.423	0.301	0.367
Box:	0.682	1.86	0.732	1.82

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.659 **Standard Deviation** 0.441 **Maximum** 1.74

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0483	0.0301	0.126	0.0425
Box:	0.286	0.197	0.192	1.3

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0523	0.00207	0.0111

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.152	0.0391	0.147

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.134	0.0418	0.174

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00331	**Sash Leakage Area / Face Area**	0.553
Box Leakage / Hood Flow	0.000119	**Box Leakage Area / Box Surface Area**	0.621

Casename run077

Date 8/31/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
4 off square layout SQ A.1 Transfer grille over main door hood -783 cfm, trunk exhaust -413 cfm, transfer grille 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	57	**Y**	48	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.394	**Standard Deviation**	0.38	**Maximum**	2.05

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.292	0.416	0.292	0.373
Box:	0.683	1.68	0.757	1.61

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.642	**Standard Deviation**	0.432	**Maximum**	1.35

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0368	0.0625	0.158	0.0743
Box:	0.28	0.243	0.245	2.33

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0396	0.00311	0.0266

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.14	0.0366	0.126

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.161	0.0445	0.16

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00273	**Sash Leakage Area / Face Area**	0.527
Box Leakage / Hood Flow	0.000079	**Box Leakage Area / Box Surface Area**	0.575

Casename run078

Date 8/31/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description

Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation

4 off square layout SQ A.1 Transfer grille over door near hood, Hood -783 cfm, Trunk exhaust -413 cfm, Trans grille 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	57	**Y**	48	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean 0.531 **Standard Deviation** 0.443 **Maximum** 2.34

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.286	0.402	0.292	0.353
Box:	0.719	1.92	0.818	1.64

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean 0.618 **Standard Deviation** 0.388 **Maximum** 1.26

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0379	0.0616	0.156	0.0648
Box:	0.379	0.302	0.233	1.77

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.117	0.0143	0.0532

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.217	0.0641	0.162

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.183	0.0662	0.187

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00293	**Sash Leakage Area / Face Area**	0.451
Box Leakage / Hood Flow	0.000089	**Box Leakage Area / Box Surface Area**	0.493

Casename run079

Date 8/31/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), supply 1097 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
4 off square layout SQ A.1 Transfer grille over main door, Hood -783 cfm, trunk exhaust -513 cfm, trans grille 200 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	63	**Y**	64	**Z**	41	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.416	Standard Deviation	0.269	Maximum	1.26

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.324	0.418	0.327	0.393
Box:	0.737	1.91	0.785	2

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.635	Standard Deviation	0.411	Maximum	1.72

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0438	0.0422	0.201	1.1
Box:	0.325	0.197	0.265	4.66

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.109	0.00632	0.0299

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.209	0.0493	0.165

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.202	0.0566	0.186

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00903	**Sash Leakage Area / Face Area**	0.468
Box Leakage / Hood Flow	0.000322	**Box Leakage Area / Box Surface Area**	0.512

Casename run080

Date 8/31/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
6 off downflow layout LAM A.1 Transfer grille over main door, Hood 0783 cfm, trunk exhaust -413 cfm, Trans grille 100 cfm

Specialist Devices	Downflow diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	50	**Y**	43	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.473	**Standard Deviation**	0.378	**Maximum**	1.75

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.378	0.453	0.376	0.456
Box:	0.881	1.99	0.939	1.92

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.631	**Standard Deviation**	0.398	**Maximum**	1.34

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0303	0.0439	0.385	0.14
Box:	0.33	0.259	0.656	10.8

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.103	0.00808	0.027

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.203	0.0469	0.152

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.259	0.101	0.275

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00492	**Sash Leakage Area / Face Area**	0.484
Box Leakage / Hood Flow	0.00037	**Box Leakage Area / Box Surface Area**	0.599

Casename run081

Date 8/31/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off radial layout TAD B.1 Transfer grille over main door, hood -783 cfm, trunk exhaust -413 cfm, trans grille 100 cfm

Specialist Devices	TAD			Fume hood		Ceiling diffuser						
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no				
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	51	**Y**	44	**Z**	33	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.34	**Standard Deviation**	0.25	**Maximum**	1.13

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.314	0.391	0.319	0.383
Box:	0.696	1.86	0.718	1.97

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.641	**Standard Deviation**	0.425	**Maximum**	1.52

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0279	0.0207	0.148	0.0618
Box:	0.214	0.152	0.227	1.8

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0	0	0

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0941	0.022	0.122

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0882	0.0225	0.138

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00371	**Sash Leakage Area / Face Area**	0.544
Box Leakage / Hood Flow	0.000104	**Box Leakage Area / Box Surface Area**	0.698

Casename run082

Date 8/31/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off square - layout SM SQ A.1, Transfer grille over main door, Hood -783 cfm, trans grille 319 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood				Ceiling diffuser			
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no			
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5 Mwords	**Grid Dimensions:**	**X**	43	**Y**	31	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.454	**Standard Deviation**	0.484	**Maximum**	2.32

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.327	0.426	0.334	0.39
Box:	0.784	1.87	0.852	1.88

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.645	**Standard Deviation**	0.447	**Maximum**	1.84

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0501	0.0587	0.205	0.0752
Box:	0.335	0.269	0.35	2.93

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0979	0.00489	0.0195

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.198	0.04	0.153

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.192	0.0509	0.197

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00374	**Sash Leakage Area / Face Area**	0.413
Box Leakage / Hood Flow	0.000118	**Box Leakage Area / Box Surface Area**	0.646

Casename run082c

Date 1/2/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
As run082; Person placed 4 inches in front of hood, Lights and ductwork recessed into ceiling

Specialist Devices	Square diffuser		Fume hood		Ceiling diffuser						
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	48	**Y**	35	**Z**	34

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.548	Standard Deviation	0.371	Maximum	1.86

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.472	1.42	0.495	1.42
Box:	0.943	3.31	0.979	2.89

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.606	Standard Deviation	0.811	Maximum	5.57

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.239	0.244	0.328	0.0809
Box:	0.433	0.32	0.513	0.709

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.102	0.00447	0.0244

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00638	0.0319
Box:	0.202	0.0724	0.255

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.00552	0.0319
Box:	0.2	0.0888	0.317

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00626	**Sash Leakage Area / Face Area**	0.55
Box Leakage / Hood Flow	0.000098	**Box Leakage Area / Box Surface Area**	0.524

Casename run083

Date 8/31/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft², equip 5.7 W/ft²)

Parametric Variation
1 off square - layout SM SQ B.1 Hood -783 cfm, trans grille 319 cfm, door crack 100 cfm

Specialist Devices	Square diffuser		Fume hood		Ceiling diffuser						
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	42	**Y**	31	**Z**	35

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.692 **Standard Deviation** 0.636 **Maximum** 3.79

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.343	0.462	0.352	0.44
Box:	0.88	2.51	1.05	2.04

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.631 **Standard Deviation** 0.434 **Maximum** 1.65

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0608	0.0774	0.287	0.101
Box:	0.402	0.461	0.459	6.37

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.234	0.0209	0.043

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.334	0.0671	0.177

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.37	0.111	0.272

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00397	**Sash Leakage Area / Face Area**	0.576
Box Leakage / Hood Flow	0.000356	**Box Leakage Area / Box Surface Area**	0.322

Casename run083c

Date 1/2/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft², equip 5.7 W/ft²)

Parametric Variation
As run083; Person placed 4 inches in front of hood, lights and ductwork recessed into ceiling

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	47	**Y**	35	**Z**	35	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.674	Standard Deviation	0.501	Maximum	3.26

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.458	1.42	0.489	1.42
Box:	0.986	3.42	1.06	3.01

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.612	Standard Deviation	0.863	Maximum	5.92

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.244	0.25	0.267	0.0828
Box:	0.51	0.445	0.45	0.788

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.207	0.0142	0.0671

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00638	0.0319
Box:	0.307	0.0991	0.286

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.00552	0.0319
Box:	0.356	0.121	0.317

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00516	**Sash Leakage Area / Face Area**	0.578
Box Leakage / Hood Flow	0.000084	**Box Leakage Area / Box Surface Area**	0.245

Casename run084

Date 8/31/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off downflow layout SM LAM A.1Hood -783 cfm, Trans grille 319 cfm, door crack 100 cfm

Specialist Devices	Downflow diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**		no			
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5 Mwords	**Grid Dimensions:**	**X**	41	**Y**	27	**Z**	34		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.498 **Standard Deviation** 0.485 **Maximum** 3.05

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.378	0.455	0.381	0.476
Box:	0.906	1.91	0.987	2.1

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.627 **Standard Deviation** 0.46 **Maximum** 1.95

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0442	0.0607	0.373	0.129
Box:	0.381	0.305	0.635	11

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0457	0.00347	0.0254

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.146	0.0446	0.161

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.209	0.0974	0.305

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00525	**Sash Leakage Area / Face Area**	0.511
Box Leakage / Hood Flow	0.000323	**Box Leakage Area / Box Surface Area**	0.555

Casename run084b

Date 4/18/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off perf hori layout SM PERF A.1 Hood -783 cfm, Trans grille 319 cfm, door crack 100 cfm

Specialist Devices	Perforated diff			Fume hood		Ceiling diffuser						
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	41	**Y**	27	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.39	Standard Deviation	0.44	Maximum	2.72

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.363	0.436	0.364	0.444
Box:	0.832	1.82	0.904	2.03

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.642	Standard Deviation	0.452	Maximum	1.5

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0393	0.0553	0.327	0.112
Box:	0.306	0.269	0.543	8.52

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0	0	0

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0763	0.0202	0.15

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.118	0.0563	0.275

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00468	**Sash Leakage Area / Face Area**	0.55
Box Leakage / Hood Flow	0.000177	**Box Leakage Area / Box Surface Area**	0.604

Casename run084c

Date 1/2/96

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
As run084; Person 4 inches in front of hood, lights and ductwork recessed into ceiling

Specialist Devices	Downflow diffuser			Fume hood			Ceiling diffuser				
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	46	**Y**	31	**Z**	34

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.592	**Standard Deviation**	0.379	**Maximum**	2.26

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.482	1.42	0.514	1.42
Box:	1.05	3.51	1.09	3.08

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.554	**Standard Deviation**	0.635	**Maximum**	3.39

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.232	0.253	0.393	0.0927
Box:	0.483	0.384	0.677	1.23

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.21	0.0188	0.0458

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00638	0.0319
Box:	0.31	0.0916	0.243

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.0865	0.00552	0.0319
Box:	0.351	0.14	0.408

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00703	**Sash Leakage Area / Face Area**	0.566
Box Leakage / Hood Flow	0.000131	**Box Leakage Area / Box Surface Area**	0.404

Casename run085

Date 8/31/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm, (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
1 off radial layout SM TAD A.1 Hood -783 cfm, Trans grille 319 cfm, door crack 100 cfm

Specialist Devices	TAD			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no				
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	39	**Y**	31	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.725	Standard Deviation	0.63	Maximum	3.73

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.366	0.458	0.378	0.467
Box:	0.94	2.6	1.12	2.01

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.627	Standard Deviation	0.437	Maximum	1.94

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0656	0.0971	0.354	0.139
Box:	0.42	0.488	0.587	12.8

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.252	0.0293	0.0539

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.352	0.0791	0.155

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.391	0.142	0.273

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00469	**Sash Leakage Area / Face Area**	0.552
Box Leakage / Hood Flow	0.000625	**Box Leakage Area / Box Surface Area**	0.267

Casename run085c

Date 1/2/96

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm, (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
As run085; Person 4 inches in front of hood, lights and ductwork recessed into ceiling

Specialist Devices	TAD			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no				
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	44	**Y**	35	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.663 **Standard Deviation** 0.492 **Maximum** 3.21

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.472	1.42	0.503	1.42
Box:	1.04	3.52	1.11	3.09

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.591 **Standard Deviation** 0.84 **Maximum** 6.73

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.242	0.25	0.319	0.0864
Box:	0.52	0.432	0.578	1.19

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.192	0.0133	0.0713

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00638	0.0319
Box:	0.292	0.101	0.279

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.0865	0.00552	0.0319
Box:	0.354	0.151	0.4

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00622	**Sash Leakage Area / Face Area**	0.57
Box Leakage / Hood Flow	0.000118	**Box Leakage Area / Box Surface Area**	0.327

Casename run086

Date 8/31/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off square layout SQ B.2 Bulk head fitted above hood Hood -783 cfm, Trunk exhaust -413 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	55	**Y**	42	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.27	Standard Deviation	0.196	Maximum	0.907

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.333	0.392	0.332	0.398
Box:	0.728	1.96	0.739	1.9

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.616	Standard Deviation	0.408	Maximum	1.47

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0335	0.0295	0.213	0.0805
Box:	0.197	0.118	0.324	3.12

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0484	0.00161	0.0119

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.148	0.0232	0.106

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.134	0.0303	0.126

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00413	**Sash Leakage Area / Face Area**	0.592
Box Leakage / Hood Flow	0.000121	**Box Leakage Area / Box Surface Area**	0.578

Casename run087

Date 8/31/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH) Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off square layout SQ B.2 Hood moved to position 2 Hood -783 cfm, trunk exhaust -413 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	58	**Y**	48	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.568 **Standard Deviation** 0.422 **Maximum** 2.03

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.278	0.392	0.276	0.389
Box:	0.738	2.18	0.835	1.66

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.633 **Standard Deviation** 0.418 **Maximum** 1.44

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.036	0.0731	0.155	0.05
Box:	0.475	0.368	0.242	3.44

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.18	0.0221	0.0489

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.28	0.0865	0.208

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.233	0.0803	0.198

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00324	**Sash Leakage Area / Face Area**	0.437
Box Leakage / Hood Flow	0.000022	**Box Leakage Area / Box Surface Area**	0.119

Casename run089

Date 8/31/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description

2 off square layout SQ B.2 Hood moved to position 3 Hood -783 cfm, Trunk exhaust -413 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**		no			
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	7	Mwords	**Grid Dimensions:**	**X**	62	**Y**	53	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.849	**Standard Deviation**	0.56	**Maximum**	3.37

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.321	0.403	0.335	0.434
Box:	0.831	2.57	1.01	1.96

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.634	**Standard Deviation**	0.366	**Maximum**	1.16

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0401	0.0898	0.184	0.064
Box:	0.644	0.537	0.37	4.44

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.259	0.0416	0.0857

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.359	0.111	0.188

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.349	0.122	0.231

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00418	**Sash Leakage Area / Face Area**	0.43
Box Leakage / Hood Flow	0.000353	**Box Leakage Area / Box Surface Area**	0.281

Casename run088

Date 8/31/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
4 off downflow layout LAM B.1 Bulkhead fitted above hood Hood -783 cfm, Trunk exhaust -413 cfm, door crack 100 cfm

Specialist Devices	Downflow diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	49	**Y**	42	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.366 **Standard Deviation** 0.273 **Maximum** 1.52

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.348	0.413	0.353	0.397
Box:	0.776	2.06	0.809	1.99

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.637 **Standard Deviation** 0.408 **Maximum** 1.38

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.033	0.014	0.286	0.124
Box:	0.202	0.144	0.443	4.79

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0338	0.000985	0.00975

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.134	0.0233	0.117

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.15	0.038	0.178

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00454	**Sash Leakage Area / Face Area**	0.54
Box Leakage / Hood Flow	0.000235	**Box Leakage Area / Box Surface Area**	0.752

Casename run091

Date 8/31/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
4 off downflow layout LAM B.1 Hood moved to position 2 Hood -783 cfm, Trunk exhaust -413 cfm, door crack 100 cfm

Specialist Devices	Downflow diffuser			Fume hood			Ceiling diffuser				
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**		no		
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5 Mwords	**Grid Dimensions:**	**X**	56	**Y**	43	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.368	Standard Deviation	0.265	Maximum	1.58

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.288	0.371	0.284	0.374
Box:	0.653	1.94	0.661	1.87

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.638	Standard Deviation	0.38	Maximum	1.29

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0302	0.0128	0.087	0.0315
Box:	0.276	0.15	0.178	3.14

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.00702	0.000123	0.00343

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.107	0.0289	0.152

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0906	0.0214	0.118

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00284	**Sash Leakage Area / Face Area**	0.538
Box Leakage / Hood Flow	0.000012	**Box Leakage Area / Box Surface Area**	0.0767

Casename run090

Date 8/31/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%) Supply 1097 cfm (9.1 ACH), Tsup 55°F 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
4 off downflow layout LAM B.1 Hood moved to position 3 Hood -783 cfm, Trunk exhaust -413 cfm, door crack 100 cfm

Specialist Devices	Downflow diffuser			Fume hood			Ceiling diffuser				
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**		no		
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5 Mwords	**Grid Dimensions:**	**X**	57	**Y**	55	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	1.14	Standard Deviation	-999	Maximum	1

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.329	0.384	1.05	1.06
Box:	0.681	2.3	1.09	1.31

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.68	Standard Deviation	0.452	Maximum	1.53

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0229	0.973	0.209	0.0788
Box:	0.317	1.14	0.345	2.66

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0	0	0

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0717	0.0138	0.108

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0663	0.0172	0.125

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00424	**Sash Leakage Area / Face Area**	0.538
Box Leakage / Hood Flow	0.000185	**Box Leakage Area / Box Surface Area**	0.713

Casename run093

Date 8/31/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off radial layout TAD A.1 Bulkhead fitted above hood Hood -783 cfm, trunk exhaust -413 cfm, door crack 100 cfm

Specialist Devices	TAD			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**		no			
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	48	**Y**	45	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.328	**Standard Deviation**	0.265	**Maximum**	1.32

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.326	0.394	0.327	0.386
Box:	0.716	1.63	0.74	1.9

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.649	**Standard Deviation**	0.414	**Maximum**	1.44

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0338	0.0334	0.193	0.0827
Box:	0.187	0.157	0.301	3.35

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.000724	0.0000127	0.00343

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.101	0.0192	0.114

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.113	0.0234	0.133

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00387	**Sash Leakage Area / Face Area**	0.526
Box Leakage / Hood Flow	0.000135	**Box Leakage Area / Box Surface Area**	0.74

Casename run092

Date 8/31/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off radial layout TAD A.1 Hood moved to position 2 Hood -783 cfm, Trunk exhaust -413 cfm, door crack 100 cfm

Specialist Devices	TAD			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5 Mwords	**Grid Dimensions:**	**X**	56	**Y**	44	**Z**	36		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.328 **Standard Deviation** 0.249 **Maximum** 1.44

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.282	0.392	0.283	0.398
Box:	0.637	2.11	0.644	2.01

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.633 **Standard Deviation** 0.413 **Maximum** 1.6

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0229	0.0197	0.0757	0.0303
Box:	0.243	0.127	0.144	2.29

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0153	0.000333	0.00686

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.115	0.0304	0.152

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0925	0.0182	0.0836

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0031	**Sash Leakage Area / Face Area**	0.525
Box Leakage / Hood Flow	0.000007	**Box Leakage Area / Box Surface Area**	0.0688

Casename run094

Date 8/31/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%) Supply 1097 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off radial layout TAD A.1 Hood moved to position 3 Hood -783 cfm, trunk exhaust -413 cfm, door crack 100 cfm

Specialist Devices	TAD			Fume hood		Ceiling diffuser						
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5 Mwords	**Grid Dimensions:**	**X**	58	**Y**	53	**Z**	33		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.3	**Standard Deviation**	0.203	**Maximum**	1.03

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.335	0.398	0.331	0.421
Box:	0.669	1.96	0.706	1.96

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.628	**Standard Deviation**	0.398	**Maximum**	1.44

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.032	0.0228	0.217	0.0641
Box:	0.21	0.141	0.379	3.08

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0	0	0

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0858	0.00948	0.0749

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.104	0.0152	0.0975

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0043	**Sash Leakage Area / Face Area**	0.552
Box Leakage / Hood Flow	0.000131	**Box Leakage Area / Box Surface Area**	0.638

Casename run095

Date 8/31/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%) Supply 365 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
1 off radial layout SM TAD A.2a Hood -783 cfm, Trans grille 319 cfm, door crack 100 cfm

Specialist Devices	TAD			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**		no			
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	39	**Y**	31	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.616 **Standard Deviation** 0.431 **Maximum** 2.55

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.361	0.438	0.364	0.448
Box:	0.882	2.08	0.992	1.84

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.636 **Standard Deviation** 0.415 **Maximum** 1.57

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0381	0.048	0.32	0.125
Box:	0.358	0.345	0.555	9

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.149	0.0192	0.0532

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.249	0.0668	0.155

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.274	0.104	0.223

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00443	**Sash Leakage Area / Face Area**	0.459
Box Leakage / Hood Flow	0.000298	**Box Leakage Area / Box Surface Area**	0.406

Casename run095c

Date 1/4/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%) Supply 365 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
As run095; Person 4 inches in front of hood, lights and ductwork recessed into ceiling

Specialist Devices	TAD			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no				
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	44	**Y**	35	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.689	Standard Deviation	0.432	Maximum	2.46

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.472	1.42	0.503	1.42
Box:	1.03	2.51	1.08	2.71

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.642	Standard Deviation	0.946	Maximum	11.6

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.237	0.257	0.329	0.0726
Box:	0.509	0.439	0.572	0.854

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.14	0.0212	0.0645

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00638	0.0319
Box:	0.24	0.101	0.283

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.00552	0.0319
Box:	0.24	0.127	0.368

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00677	**Sash Leakage Area / Face Area**	0.57
Box Leakage / Hood Flow	0.000086	**Box Leakage Area / Box Surface Area**	0.476

Casename run096

Date 8/31/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
diffusers 24 x 24" (1 off) layout SM TAD A.2b Hood -783 cfm, Trans grille 319 cfm, door crack 100 cfm

Specialist Devices	TAD			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	41	**Y**	29	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.545	**Standard Deviation**	0.414	**Maximum**	2.33

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.374	0.459	0.385	0.496
Box:	0.929	2.2	0.989	2.17

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.668	**Standard Deviation**	0.493	**Maximum**	1.66

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0421	0.069	0.364	0.117
Box:	0.4	0.284	0.613	10.4

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.137	0.0107	0.0285

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.237	0.0624	0.18

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.327	0.122	0.306

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00496	**Sash Leakage Area / Face Area**	0.58
Box Leakage / Hood Flow	0.000327	**Box Leakage Area / Box Surface Area**	0.343

Casename run096c

Date 1/4/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
As run096; Person 4 inches in front of hood, lights and ductwork recessed into ceiling

Specialist Devices	TAD		Fume hood		Ceiling diffuser						
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5 Mwords	**Grid Dimensions:**	**X**	46	**Y**	33	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	Standard Deviation	Maximum
0.654	0.425	2.07

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.46	1.42	0.504	1.42
Box:	1.07	2.88	1.08	3.05

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	Standard Deviation	Maximum
0.586	0.703	5.16

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.221	0.258	0.306	0.0692
Box:	0.591	0.418	0.568	0.783

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0557	0.00409	0.034

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00638	0.0319
Box:	0.156	0.116	0.388

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.00552	0.0319
Box:	0.203	0.174	0.456

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00707	**Sash Leakage Area / Face Area**	0.58
Box Leakage / Hood Flow	0.000070	**Box Leakage Area / Box Surface Area**	0.431

Casename run097

Date 8/31/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
1 off radial layout SM TAD A.1b Hood -783 cfm, Trans grille 319 cfm, door crack 100 cfm

Specialist Devices	TAD			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**		no			
Concentration	From hood		**Turbulence**	ke model		**Special**						
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	41	**Y**	29	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.686 **Standard Deviation** 0.581 **Maximum** 3.6

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.357	0.46	0.368	0.456
Box:	0.898	2.45	1.07	2.05

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.633 **Standard Deviation** 0.442 **Maximum** 1.7

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0623	0.0899	0.315	0.123
Box:	0.402	0.463	0.534	10.1

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.221	0.0211	0.05

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.321	0.0655	0.138

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.355	0.122	0.259

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00436	**Sash Leakage Area / Face Area**	0.543
Box Leakage / Hood Flow	0.00044	**Box Leakage Area / Box Surface Area**	0.258

Casename run098

Date 8/31/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%) Supply 365 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
As run097; Person 4 inches in front of hood, lighting and ductwork recessed into ceiling

Specialist Devices	TAD		Fume hood		Ceiling diffuser						
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5 Mwords	**Grid Dimensions:**	**X**	46	**Y**	33	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.65	**Standard Deviation**	0.494	**Maximum**	3.19

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.473	1.42	0.503	1.42
Box:	1.03	3.47	1.1	3.04

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.629	**Standard Deviation**	1.21	**Maximum**	14.9

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.242	0.25	0.323	0.0875
Box:	0.5	0.429	0.58	1.31

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.198	0.0124	0.0485

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00638	0.0319
Box:	0.298	0.0967	0.276

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.0865	0.00552	0.0319
Box:	0.35	0.147	0.366

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00633	**Sash Leakage Area / Face Area**	0.562
Box Leakage / Hood Flow	0.000114	**Box Leakage Area / Box Surface Area**	0.332

Casename run097c

Date 1/8/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off downflow layout SM LAM A.2 Hood -783 cfm, trans grille 319 cfm, door crack 100 cfm

Specialist Devices	Downflow diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	40	**Y**	29	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.592 **Standard Deviation** 0.518 **Maximum** 2.76

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.369	0.462	0.384	0.508
Box:	0.933	2.06	1.04	2.23

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.638 **Standard Deviation** 0.45 **Maximum** 2.05

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0433	0.0838	0.345	0.117
Box:	0.401	0.374	0.597	10.5

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.113	0.0141	0.0526

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.213	0.0632	0.179

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.236	0.112	0.279

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00543	**Sash Leakage Area / Face Area**	0.533
Box Leakage / Hood Flow	0.000354	**Box Leakage Area / Box Surface Area**	0.393

As run098; Person 4 inches in front of hood, lights and ductwork recessed into ceiling

Specialist Devices	Downflow diffuser			Fume hood			Ceiling diffuser						
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**		no				
Concentration	From hood	**Turbulence**	ke model	**Special**									
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	45	**Y**	33	**Z**	34		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.601	**Standard Deviation**	0.479	**Maximum**	2.69

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.475	1.42	0.513	1.42
Box:	1.05	3.27	1.07	2.92

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.494	**Standard Deviation**	0.609	**Maximum**	5.15

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.222	0.25	0.359	0.0853
Box:	0.525	0.361	0.614	0.983

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0558	0.00358	0.0264

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00638	0.0319
Box:	0.156	0.0894	0.339

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.0865	0.00552	0.0319
Box:	0.178	0.139	0.473

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00688	**Sash Leakage Area / Face Area**	0.564
Box Leakage / Hood Flow	0.000117	**Box Leakage Area / Box Surface Area**	0.49

Casename run098c

Date 3/21/95

Description

Model Internal
Flow Forced
Application Types Laboratory Fume hood

Case Description

Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (16.6 ACH), Tsup 55°F 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation

2 off downflow layout SM LAM A.3 Hood -783 cfm, Trans grille 319 cfm, door crack 100 cfm

Specialist Devices	Downflow diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	40	**Y**	29	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.456	**Standard Deviation**	0.31	**Maximum**	1.68

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.374	0.432	0.376	0.432
Box:	0.853	2.07	0.902	2.02

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.649	**Standard Deviation**	0.414	**Maximum**	1.51

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.042	0.0294	0.389	0.165
Box:	0.277	0.213	0.647	8.24

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.067	0.004	0.0232

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.167	0.0366	0.127

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.197	0.0681	0.21

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00485	**Sash Leakage Area / Face Area**	0.472
Box Leakage / Hood Flow	0.000335	**Box Leakage Area / Box Surface Area**	0.63

Casename run099b

Date 4/18/96

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft², (equip 5.7 W/ft²)

Parametric Variation
2 off perf hori layout SM PERF A.2 Hood -783 cfm, Trans grille 319 cfm, door crack 100 cfm

Specialist Devices	Perforated diff		Fume hood		Ceiling diffuser							
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5 Mwords	**Grid Dimensions:**	**X**	40	**Y**	29	**Z**	34		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.553 **Standard Deviation** 0.649 **Maximum** 3.77

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.334	0.449	0.35	0.418
Box:	0.858	2.01	1	2.25

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.613 **Standard Deviation** 0.423 **Maximum** 1.64

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0581	0.104	0.233	0.0883
Box:	0.408	0.425	0.437	5.71

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.102	0.0131	0.0499

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.202	0.0602	0.184

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.247	0.102	0.269

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00365	**Sash Leakage Area / Face Area**	0.515
Box Leakage / Hood Flow	0.000215	**Box Leakage Area / Box Surface Area**	0.453

Casename run099c

Date 1/2/96

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft², (equip 5.7 W/ft²)

Parametric Variation
As run099; Person 4 inches in front of hood, lights and ductwork recessed into ceiling

Specialist Devices	Downflow diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	45	**Y**	32	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.553	**Standard Deviation**	0.302	**Maximum**	1.45

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.49	1.42	0.515	1.42
Box:	0.985	3.2	1.04	2.8

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.57	**Standard Deviation**	0.786	**Maximum**	5.44

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.238	0.248	0.397	0.133
Box:	0.39	0.342	0.66	0.897

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0995	0.00485	0.0433

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00638	0.0319
Box:	0.2	0.0682	0.218

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.0865	0.00552	0.0319
Box:	0.239	0.0943	0.305

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00642	**Sash Leakage Area / Face Area**	0.526
Box Leakage / Hood Flow	0.000133	**Box Leakage Area / Box Surface Area**	0.454

Casename run100

Date 8/31/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off downflow layout SM LAM A.4 Hood -783 cfm, Trans grille 319 cfm, door crack 100 cfm

Specialist Devices	Downflow diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5 Mwords	**Grid Dimensions:**	**X**	40	**Y**	29	**Z**	34		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.807	Standard Deviation	0.582	Maximum	2.7

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.338	0.489	0.362	0.488
Box:	0.91	2.87	1.13	2.19

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.64	Standard Deviation	0.431	Maximum	2.14

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0545	0.132	0.218	0.0825
Box:	0.548	0.568	0.465	8.76

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.306	0.0505	0.068

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.406	0.106	0.199

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.465	0.161	0.262

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00376	**Sash Leakage Area / Face Area**	0.473
Box Leakage / Hood Flow	0.000518	**Box Leakage Area / Box Surface Area**	0.141

Casename run100c

Date 1/2/96

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
As run100; Person 4 inches in front of hood, lights and ductwork recessed into ceiling

Specialist Devices	Downflow diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**		no			
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	45	**Y**	33	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.861	**Standard Deviation**	0.536	**Maximum**	2.27

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.455	1.42	0.492	1.42
Box:	1	3.36	1.19	2.95

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.481	**Standard Deviation**	0.538	**Maximum**	3.01

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.225	0.264	0.274	0.0924
Box:	0.588	0.578	0.505	0.866

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.353	0.0577	0.0573

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00638	0.0319
Box:	0.453	0.118	0.231

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.0865	0.00552	0.0319
Box:	0.51	0.163	0.352

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00489	**Sash Leakage Area / Face Area**	0.589
Box Leakage / Hood Flow	0.000081	**Box Leakage Area / Box Surface Area**	0.221

Casename run101

Date 8/31/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off downflow layout SM LAM A.5 Hood -783 cfm, trans grille 319 cfm, door crack 100 cfm

Specialist Devices	Downflow diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	41	**Y**	27	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.763	**Standard Deviation**	0.579	**Maximum**	3.43

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.372	0.483	0.396	0.5
Box:	0.998	2.35	1.18	2.35

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.66	**Standard Deviation**	0.455	**Maximum**	1.93

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0424	0.128	0.341	0.114
Box:	0.521	0.533	0.649	17.3

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.12	0.0311	0.106

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.22	0.104	0.186

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.286	0.184	0.319

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00516	**Sash Leakage Area / Face Area**	0.462
Box Leakage / Hood Flow	0.000582	**Box Leakage Area / Box Surface Area**	0.288

Casename run101b

Date 4/18/96

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off perf horizontal layout SM PERF A.3 Hood -783 cfm, trans grille 319 cfm, door crack 100 cfm

Specialist Devices	Perforated diff			Fume hood		Ceiling diffuser						
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5 Mwords	**Grid Dimensions:**	**X**	41	**Y**	27	**Z**	34		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.677 **Standard Deviation** 0.641 **Maximum** 3.33

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.334	0.414	0.364	0.412
Box:	0.918	2.42	1.07	2.32

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.636 **Standard Deviation** 0.443 **Maximum** 1.41

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0605	0.154	0.21	0.0981
Box:	0.527	0.535	0.433	9.05

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.102	0.0201	0.0737

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.202	0.0796	0.187

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.214	0.118	0.262

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00335	**Sash Leakage Area / Face Area**	0.496
Box Leakage / Hood Flow	0.000184	**Box Leakage Area / Box Surface Area**	0.288

Casename run101c

Date 1/2/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
As run101; Person 4 inches in front of hood, lights and ductwork recessed into ceiling.

Specialist Devices	Downflow diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**		no			
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5 Mwords	**Grid Dimensions:**	**X**	46	**Y**	30	**Z**	34		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.825	Standard Deviation	0.51	Maximum	3.02

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.475	1.42	0.517	1.42
Box:	1.08	3.44	1.24	3.03

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.537	Standard Deviation	0.567	Maximum	2.27

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.231	0.27	0.369	0.177
Box:	0.617	0.567	0.7	1.21

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.169	0.022	0.0741

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00638	0.0319
Box:	0.269	0.113	0.294

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.00552	0.0319
Box:	0.334	0.197	0.424

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00494	**Sash Leakage Area / Face Area**	0.504
Box Leakage / Hood Flow	0.000113	**Box Leakage Area / Box Surface Area**	0.355

Casename run102

Date 8/31/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm(100%), Supply 365 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off square layout SM SQ A.2a Hood -783 cfm, trans grille319 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser				
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**	no			
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5 Mwords	**Grid Dimensions:**	**X**	43	**Y**	32	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.353 **Standard Deviation** 0.384 **Maximum** 2.14

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.357	0.411	0.363	0.417
Box:	0.808	1.72	0.883	1.99

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.667 **Standard Deviation** 0.532 **Maximum** 2.51

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0393	0.0632	0.326	1.38
Box:	0.247	0.256	0.49	11.7

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0374	0.000984	0.00739

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.137	0.0221	0.102

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.167	0.053	0.217

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0113	**Sash Leakage Area / Face Area**	0.529
Box Leakage / Hood Flow	0.00033	**Box Leakage Area / Box Surface Area**	0.463

Casename run102c

Date 1/2/96

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm(100%), Supply 365 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
As run102; Person 4 inches in front of hood, lights and ductwork recessed into ceiling

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5 Mwords	**Grid Dimensions:**	**X**	43	**Y**	32	**Z**	34		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.536	**Standard Deviation**	0.415	**Maximum**	2.58

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.465	1.42	0.492	1.42
Box:	0.974	3.01	1.02	2.65

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.706	**Standard Deviation**	1.27	**Maximum**	8.09

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.237	0.246	0.323	1.06
Box:	0.432	0.391	0.526	2.08

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.00952	0.000305	0.00765

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00638	0.0319
Box:	0.11	0.0725	0.288

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.0865	0.00552	0.0319
Box:	0.146	0.0977	0.395

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0135	**Sash Leakage Area / Face Area**	0.577
Box Leakage / Hood Flow	0.00017	**Box Leakage Area / Box Surface Area**	0.348

Casename run103

Date 8/31/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off square layout SM SQ A.2 Bulkhead fitted above hood Hood -783 cfm, Trans grille 319 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	43	**Y**	32	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.392 **Standard Deviation** 0.421 **Maximum** 2.39

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.358	0.411	0.366	0.414
Box:	0.826	1.71	0.895	2.01

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.677 **Standard Deviation** 0.497 **Maximum** 1.8

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0453	0.0723	0.333	1.38
Box:	0.299	0.271	0.5	10.7

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0246	0.000447	0.00737

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.125	0.0241	0.139

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.142	0.0546	0.249

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0113	**Sash Leakage Area / Face Area**	0.512
Box Leakage / Hood Flow	0.000331	**Box Leakage Area / Box Surface Area**	0.507

Casename run103c

Date 1/3/96

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
As run103; Person 4 inches in front of hood, lights and ductwork recessed into ceiling

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**		no			
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5 Mwords	**Grid Dimensions:**	**X**	48	**Y**	36	**Z**	34		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.553	**Standard Deviation**	0.422	**Maximum**	2.63

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.465	1.42	0.493	1.42
Box:	0.974	2.91	1.03	2.64

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.662	**Standard Deviation**	1.17	**Maximum**	9.69

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.238	0.248	0.314	1.06
Box:	0.443	0.397	0.503	2.06

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0242	0.00124	0.0309

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00638	0.0319
Box:	0.124	0.078	0.275

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.0865	0.00552	0.0319
Box:	0.173	0.1	0.351

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0137	**Sash Leakage Area / Face Area**	0.566
Box Leakage / Hood Flow	0.000172	**Box Leakage Area / Box Surface Area**	0.337

Casename run104

Date 8/31/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH) Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
1 off square layout SM SQ B.2 Hood -783 cfm, transfer grille 319 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser				
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	43	**Y**	31	**Z**	33

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.49 **Standard Deviation** 0.353 **Maximum** 2.05

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.386	0.474	0.385	0.496
Box:	0.905	1.83	0.969	1.88

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.641 **Standard Deviation** 0.432 **Maximum** 1.36

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0372	0.0558	0.417	0.174
Box:	0.306	0.265	0.687	16.5

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0752	0.00593	0.0309

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.175	0.044	0.136

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.194	0.0909	0.284

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00508	**Sash Leakage Area / Face Area**	0.507
Box Leakage / Hood Flow	0.000422	**Box Leakage Area / Box Surface Area**	0.576

Casename run105

Date 8/31/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description

Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**		no			
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	43	**Y**	35	**Z**	33	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean 0.604 **Standard Deviation** 0.339 **Maximum** 1.97

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.525	1.42	0.556	1.42
Box:	1.05	2.84	1.07	2.91

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean 0.417 **Standard Deviation** 0.415 **Maximum** 1.6

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.344	0.347	0.335	0.0778
Box:	0.479	0.393	0.592	0.78

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0719	0.00392	0.0245

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.0119	0.0595
Box:	0.172	0.0987	0.318

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.0865	0.0103	0.0595
Box:	0.197	0.123	0.429

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0055	**Sash Leakage Area / Face Area**	0.601
Box Leakage / Hood Flow	0.000060	**Box Leakage Area / Box Surface Area**	0.382

Casename run104c

Date 1/3/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description

Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH) Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation

As run104, Person 2M SG Sit Part forward, hood blanked off, hood 783 cfm, ceiling grille 319, door crack 100 cfm

As run104, Person 4 inches in front of hood, lights and electric recessed into ceiling

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	41	**Y**	31	**Z**	33	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean 0.394 **Standard Deviation** 0.311 **Maximum** 1.57

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.341	0.386	0.341	0.388
Box:	0.782	1.82	0.824	1.67

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean 0.64 **Standard Deviation** 0.431 **Maximum** 1.42

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0563	0.0704	0.256	0.0923
Box:	0.29	0.2	0.434	4.6

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0808	0.00372	0.0201

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.181	0.0342	0.135

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.189	0.0561	0.216

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00434	**Sash Leakage Area / Face Area**	0.528
Box Leakage / Hood Flow	0.000163	**Box Leakage Area / Box Surface Area**	0.492

Casename run105c

Date 1/3/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
As run105; Person 4 inches in front of hood, lights and ductwork recessed into ceiling

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**		no			
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5 Mwords	**Grid Dimensions:**	**X**	41	**Y**	35	**Z**	33		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.565	Standard Deviation	0.315	Maximum	1.56

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.499	1.42	0.542	1.42
Box:	0.992	2.86	1.03	2.63

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.48	Standard Deviation	0.678	Maximum	4.86

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.308	0.342	0.311	0.0768
Box:	0.484	0.382	0.529	0.702

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.113	0.00518	0.0207

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00932	0.0466
Box:	0.213	0.0953	0.314

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.00806	0.0466
Box:	0.253	0.113	0.401

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0054	**Sash Leakage Area / Face Area**	0.589
Box Leakage / Hood Flow	0.000067	**Box Leakage Area / Box Surface Area**	0.343

Casename run106

Date 11/6/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description

Large laboratory (33 x 22), hood(posn 3)100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F 12.8°C, heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation

2 off square-layout SQ B.1 - trans grille door near hood Hood -783 cfm, Trunk exhaust -413 cfm, transfer grille 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	62	**Y**	61	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean 0.456 **Standard Deviation** 0.347 **Maximum** 2.14

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.311	0.377	0.322	0.374
Box:	0.719	2.2	0.79	2.08

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean 0.643 **Standard Deviation** 0.435 **Maximum** 1.61

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0691	0.123	0.161	0.077
Box:	0.428	0.316	0.336	3.71

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0719	0.00294	0.0236

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.172	0.0345	0.129

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.201	0.0484	0.165

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00286	**Sash Leakage Area / Face Area**	0.512
Box Leakage / Hood Flow	0.000089	**Box Leakage Area / Box Surface Area**	0.429

Casename run107

Date 11/6/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description

Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F 12.8°C, heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation

2 off square - layout SQ B.1 - door & trans grille moved near hood. Hood -783 cfm, Trunk exhaust -413 cfm, transfer grille 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser						
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no						
Concentration	From hood	**Turbulence**	ke model	**Special**									
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	53	**Y**	49	**Z**	34		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean 0.408 **Standard Deviation** 0.408 **Maximum** 2.16

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.295	0.393	0.325	0.377
Box:	0.766	2.42	0.815	2.32

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean 0.667 **Standard Deviation** 0.508 **Maximum** 1.6

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0841	0.136	0.162	0.115
Box:	0.432	0.333	0.239	2.76

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0238	0.000431	0.00354

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.124	0.0379	0.205

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.127	0.0499	0.217

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00233	**Sash Leakage Area / Face Area**	0.522
Box Leakage / Hood Flow	0.000071	**Box Leakage Area / Box Surface Area**	0.361

Casename run108

Date 11/6/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
Radial Diffuser - Layout SM TAD A.1a - trans grille moved away from hood. Hood -783 cfm, Transfer grille 319 cfm, door crack 100 cfm

Specialist Devices	TAD			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	3	Mwords	**Grid Dimensions:**	**X**	39	**Y**	31	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.366	**Standard Deviation**	0.307	**Maximum**	1.84

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.411	0.45	0.414	0.462
Box:	0.935	2.09	0.968	1.99

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.624	**Standard Deviation**	0.405	**Maximum**	1.34

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0474	0.0279	0.539	0.231
Box:	0.258	0.157	0.843	15.5

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0578	0.0021	0.0184

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.158	0.0293	0.14

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.179	0.0887	0.34

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00648	**Sash Leakage Area / Face Area**	0.464
Box Leakage / Hood Flow	0.000538	**Box Leakage Area / Box Surface Area**	0.578

Casename run108c

Date 1/3/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
As run108; Person 4 inches in front of hood, lights and ductwork recessed into ceiling

Specialist Devices	TAD			Fume hood		Ceiling diffuser						
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	3	Mwords	**Grid Dimensions:**	**X**	44	**Y**	35	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.489	Standard Deviation	0.29	Maximum	1.56

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.498	1.42	0.525	1.42
Box:	1.08	3.61	1.07	3.17

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.487	Standard Deviation	0.552	Maximum	3.31

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.232	0.243	0.451	0.11
Box:	0.48	0.259	0.76	1.62

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.136	0.00991	0.048

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00638	0.0319
Box:	0.236	0.0916	0.291

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.00552	0.0319
Box:	0.231	0.153	0.471

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00858	**Sash Leakage Area / Face Area**	0.546
Box Leakage / Hood Flow	0.000196	**Box Leakage Area / Box Surface Area**	0.536

Casename run109

Date 11/6/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 402 cfm (10.0 ACH), Tsup 57°F 13.7°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
Radial Diffuser - Layout SM TAD A.1a Hood -783 cfm, Transfer grille 281 cfm, door crack 100 cfm

Specialist Devices	TAD			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	3	Mwords	**Grid Dimensions:**	**X**	39	**Y**	31	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.602	Standard Deviation	0.52	Maximum	3.19

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.343	0.444	0.353	0.448
Box:	0.879	2.22	0.975	2.1

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.647	Standard Deviation	0.458	Maximum	1.75

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0584	0.0705	0.293	0.108
Box:	0.423	0.378	0.478	9.03

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.155	0.0109	0.0259

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.255	0.0621	0.188

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.305	0.114	0.283

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00419	**Sash Leakage Area / Face Area**	0.58
Box Leakage / Hood Flow	0.000445	**Box Leakage Area / Box Surface Area**	0.292

Casename run109c

Date 1/3/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 402 cfm (10.0 ACH), Tsup 57°F 13.7°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
As run109; Person 4 inches in front of hood, lights and ductwork recessed into ceiling

Specialist Devices	TAD			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no				
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	44	**Y**	35	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.593	Standard Deviation	0.421	Maximum	2.77

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.467	1.42	0.498	1.42
Box:	1.02	3.46	1.06	3.03

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.71	Standard Deviation	1.81	Maximum	16.8

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.239	0.247	0.304	0.0874
Box:	0.507	0.371	0.533	1.11

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0923	0.0103	0.0759

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00638	0.0319
Box:	0.192	0.0978	0.285

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.00552	0.0319
Box:	0.25	0.135	0.377

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00611	**Sash Leakage Area / Face Area**	0.57
Box Leakage / Hood Flow	0.000103	**Box Leakage Area / Box Surface Area**	0.348

Casename run110

Date 11/6/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 402 cfm (10.0 ACH), Tsup 57°F 13.7°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off Square - Layout SM SQ A.1 Hood -783 cfm, Transfer grille 281 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	3	Mwords	**Grid Dimensions:**	**X**	43	**Y**	31	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.331	**Standard Deviation**	0.228	**Maximum**	1.35

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.338	0.398	0.34	0.387
Box:	0.735	2.03	0.756	1.98

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.613	**Standard Deviation**	0.395	**Maximum**	1.21

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0315	0.0215	0.245	0.0992
Box:	0.194	0.118	0.366	3.3

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0449	0.000849	0.0037

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.145	0.0185	0.112

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.138	0.0223	0.107

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00418	**Sash Leakage Area / Face Area**	0.578
Box Leakage / Hood Flow	0.000141	**Box Leakage Area / Box Surface Area**	0.625

Casename run110c

Date 1/17/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 402 cfm (10.0 ACH), Tsup 57°F 13.7°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
As run 110; Person 4 inches in front of hood, lighting and ductwork recessed into ceiling

Specialist Devices	Square diffuser		Fume hood		Ceiling diffuser							
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	48	**Y**	35	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.408	Standard Deviation	0.212	Maximum	0.995

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.469	1.42	0.491	1.42
Box:	0.897	3.38	0.889	2.96

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.47	Standard Deviation	0.471	Maximum	2.05

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.232	0.246	0.323	0.0879
Box:	0.352	0.213	0.463	0.646

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.113	0.00489	0.0236

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00638	0.0319
Box:	0.213	0.061	0.221

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.00552	0.0319
Box:	0.182	0.0602	0.265

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00581	**Sash Leakage Area / Face Area**	0.586
Box Leakage / Hood Flow	0.000083	**Box Leakage Area / Box Surface Area**	0.469

Casename run111

Date 11/6/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
1 off Square - Layout SM SQ B.3b (side blanked) Hood -783 cfm, Transfer grille 319 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	3	Mwords	**Grid Dimensions:**	**X**	43	**Y**	31	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.674	**Standard Deviation**	0.424	**Maximum**	2.38

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.354	0.458	0.365	0.462
Box:	0.933	2.41	1.03	1.95

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.621	**Standard Deviation**	0.418	**Maximum**	1.57

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0515	0.107	0.282	0.114
Box:	0.464	0.416	0.502	11.8

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.215	0.0312	0.0753

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.315	0.0933	0.193

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.344	0.129	0.259

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00529	**Sash Leakage Area / Face Area**	0.453
Box Leakage / Hood Flow	0.000549	**Box Leakage Area / Box Surface Area**	0.275

Casename run111c

Date 1/3/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
As run111; Person 4 inches in front of hood, lights and ductwork recessed into ceiling

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser				
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5 Mwords	**Grid Dimensions:**	**X**	46	**Y**	35	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.653	Standard Deviation	0.351	Maximum	1.78

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.499	1.42	0.537	1.42
Box:	1.08	3.14	1.11	2.9

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.989	Standard Deviation	3.55	Maximum	24.5

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.263	0.297	0.343	0.0855
Box:	0.578	0.436	0.571	0.915

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.166	0.0186	0.0687

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00792	0.0396
Box:	0.266	0.117	0.318

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.00685	0.0396
Box:	0.312	0.148	0.43

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0069	**Sash Leakage Area / Face Area**	0.541
Box Leakage / Hood Flow	0.000083	**Box Leakage Area / Box Surface Area**	0.447

Casename run112

Date 11/6/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
1 off Square - Layout SM SQ B.3a (all sides active) Hood -783 cfm, Transfer grille 319 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	3	Mwords	**Grid Dimensions:**	**X**	46	**Y**	31	**Z**	33	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.87	**Standard Deviation**	0.636	**Maximum**	3.77

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.332	0.46	0.398	0.504
Box:	1.04	2.9	1.17	2.73

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.619	**Standard Deviation**	0.497	**Maximum**	2.26

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0595	0.201	0.187	0.0978
Box:	0.762	0.624	0.383	12.1

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.149	0.033	0.0929

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.249	0.119	0.297

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.302	0.174	0.345

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0045	**Sash Leakage Area / Face Area**	0.521
Box Leakage / Hood Flow	0.000541	**Box Leakage Area / Box Surface Area**	0.221

Casename run112c

Date 1/3/96

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
As run112; Person 4 inches in front of hood, lights and ductwork recessed into ceiling

Specialist Devices	Square diffuser			Fume hood				Ceiling diffuser			
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**		no		
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	3 Mwords	**Grid Dimensions:**	**X**	46	**Y**	35	**Z**	33	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.973	**Standard Deviation**	0.511	**Maximum**	3.64

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.468	1.42	0.543	1.42
Box:	1.18	3.93	1.3	3.7

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.426	**Standard Deviation**	0.482	**Maximum**	2.33

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.253	0.331	0.271	0.104
Box:	0.794	0.67	0.452	0.971

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.174	0.0351	0.0997

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00792	0.0396
Box:	0.274	0.172	0.396

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.0865	0.00685	0.0396
Box:	0.325	0.204	0.473

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00547	**Sash Leakage Area / Face Area**	0.546
Box Leakage / Hood Flow	0.000056	**Box Leakage Area / Box Surface Area**	0.405

Casename run113

Date 11/6/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
1 off Square - Layout SM SQ B.3a (all sides active) bulkhead. Hood -783 cfm, Transfer grille 319 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	3	Mwords	**Grid Dimensions:**	**X**	46	**Y**	31	**Z**	33	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.916	**Standard Deviation**	0.628	**Maximum**	3.68

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.338	0.469	0.432	0.579
Box:	1.1	3.49	1.21	3.29

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.624	**Standard Deviation**	0.53	**Maximum**	3.04

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0668	0.243	0.198	0.101
Box:	0.832	0.668	0.389	11.4

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.18	0.0448	0.118

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.28	0.143	0.306

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.328	0.195	0.398

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0044	**Sash Leakage Area / Face Area**	0.494
Box Leakage / Hood Flow	0.00062	**Box Leakage Area / Box Surface Area**	0.217

Casename run113c

Date 1/15/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
As run113; Person 4 inches in front of hood, lighting and ductwork recessed into ceiling

Specialist Devices	Square diffuser		Fume hood		Ceiling diffuser						
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5 Mwords	**Grid Dimensions:**	**X**	46	**Y**	35	**Z**	33	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	1.01	Standard Deviation	0.505	Maximum	3.55

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.465	1.42	0.563	1.42
Box:	1.21	4.32	1.32	4.09

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.419	Standard Deviation	0.496	Maximum	2.55

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.249	0.353	0.271	0.107
Box:	0.827	0.7	0.438	0.901

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.194	0.0423	0.122

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00792	0.0396
Box:	0.294	0.186	0.402

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.00685	0.0396
Box:	0.341	0.212	0.482

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00522	**Sash Leakage Area / Face Area**	0.562
Box Leakage / Hood Flow	0.000048	**Box Leakage Area / Box Surface Area**	0.379

Casename run114

Date 11/6/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood (posn2)100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
1 Radial - Layout SM TAD A.1b Hood -783 cfm, Transfer grille 319 cfm, door crack 100 cfm

Specialist Devices	TAD			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no				
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	3	Mwords	**Grid Dimensions:**	**X**	49	**Y**	27	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.448 **Standard Deviation** 0.361 **Maximum** 1.77

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.281	0.376	0.275	0.377
Box:	0.699	2.1	0.715	1.78

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.641 **Standard Deviation** 0.387 **Maximum** 1.43

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0713	0.0503	0.0652	0.0241
Box:	0.378	0.231	0.149	0.364

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.154	0.00712	0.0228

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.254	0.053	0.169

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.245	0.0473	0.165

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00244	**Sash Leakage Area / Face Area**	0.565
Box Leakage / Hood Flow	0.000040	**Box Leakage Area / Box Surface Area**	0.502

Casename run115

Date 11/6/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood(posn3) 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
1 Radial - Layout SM TAD A.1b Hood -783 cfm, Transfer grille 319 cfm, door crack 100 cfm

Specialist Devices	TAD			Fume hood		Ceiling diffuser						
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	3 Mwords	**Grid Dimensions:**	**X**	42	**Y**	33	**Z**	34		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.552	Standard Deviation	0.371	Maximum	1.75

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.412	0.492	0.416	0.492
Box:	1.02	2.35	1.12	1.84

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.638	Standard Deviation	0.401	Maximum	1.32

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0455	0.0918	0.532	0.182
Box:	0.441	0.369	0.948	29.7

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.173	0.0244	0.0623

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.273	0.0777	0.166

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.367	0.187	0.347

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00707	**Sash Leakage Area / Face Area**	0.503
Box Leakage / Hood Flow	0.00121	**Box Leakage Area / Box Surface Area**	0.417

Casename run116c

Date 1/3/96

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description

Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation

Radial diffuser from front of hood, layout SMTAD1A, Hood 783 cfm, Transfer grille 319 cfm, door crack 105 cfm
Actual 110, Person 4 inches in front of hood, lights and ductwork recessed in ceiling

Specialist Devices	TAD			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	3	Mwords	**Grid Dimensions:**	**X**	37	**Y**	29	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.678	**Standard Deviation**	0.506	**Maximum**	2.83

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.361	0.467	0.381	0.489
Box:	0.953	2.31	1.11	2.41

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.612	**Standard Deviation**	0.409	**Maximum**	1.31

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.041	0.115	0.305	0.0999
Box:	0.484	0.474	0.581	15.9

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0801	0.0225	0.105

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.18	0.0906	0.193

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.235	0.166	0.311

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00503	**Sash Leakage Area / Face Area**	0.476
Box Leakage / Hood Flow	0.000456	**Box Leakage Area / Box Surface Area**	0.31

Casename run116

Date 11/6/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description

Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation

Specialist Devices	TAD			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5 Mwords	**Grid Dimensions:**	**X**	42	**Y**	33	**Z**	34		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.63	**Standard Deviation**	0.443	**Maximum**	2.21

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.478	1.42	0.514	1.42
Box:	1.06	3.42	1.1	3.13

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.596	**Standard Deviation**	0.887	**Maximum**	6.51

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.234	0.264	0.374	0.092
Box:	0.54	0.435	0.64	1.5

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.115	0.0157	0.0562

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00638	0.0319
Box:	0.215	0.1	0.261

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.0865	0.00552	0.0319
Box:	0.249	0.16	0.444

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00622	**Sash Leakage Area / Face Area**	0.545
Box Leakage / Hood Flow	0.000121	**Box Leakage Area / Box Surface Area**	0.393

Casename run117c

Date 1/3/96

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F 12.8°C, total heat load 8 W/ft²
(equip 5.7 W/ft²)

Parametric Variation
As run117; + bulkhead 4 in. layout SM TAD A 3, Hood 783 cfm, Transfer grille 319 cfm, door crack 100 cfm; lights and ductwork recessed into ceiling

Specialist Devices	TAD			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**		Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**		ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	3	Mwords	**Grid Dimensions:**		**X**	37	**Y**	29	**Z**	34

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.664	**Standard Deviation**	0.52	**Maximum**	2.97

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.362	0.471	0.383	0.507
Box:	0.948	2.36	1.12	2.43

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.624	**Standard Deviation**	0.419	**Maximum**	1.4

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0439	0.125	0.299	0.101
Box:	0.462	0.482	0.602	17.4

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.111	0.0181	0.0899

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.211	0.0874	0.211

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.247	0.167	0.296

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00491	**Sash Leakage Area / Face Area**	0.498
Box Leakage / Hood Flow	0.000441	**Box Leakage Area / Box Surface Area**	0.264

Casename run117

Date 11/6/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description

Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation

Specialist Devices	TAD			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no				
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	42	**Y**	33	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.63	**Standard Deviation**	0.401	**Maximum**	1.7

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.476	1.42	0.509	1.42
Box:	1.04	3.34	1.1	3.08

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.495	**Standard Deviation**	0.543	**Maximum**	2.44

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.234	0.261	0.372	0.0919
Box:	0.543	0.427	0.638	1.46

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0825	0.0127	0.0555

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00638	0.0319
Box:	0.182	0.0974	0.255

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.0865	0.00552	0.0319
Box:	0.238	0.161	0.414

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00609	**Sash Leakage Area / Face Area**	0.56
Box Leakage / Hood Flow	0.000118	**Box Leakage Area / Box Surface Area**	0.392

Casename run118c

Date 1/3/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 684 cfm (17 ACH), Tsup 63°F 17.2°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off 12" square - layout SM SQ A.1 Hood -783 cfm, Transfer grille SHUT, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	3	Mwords	**Grid Dimensions:**	**X**	43	**Y**	31	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.439 **Standard Deviation** 0.312 **Maximum** 1.65

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.299	0.407	0.31	0.368
Box:	0.764	2.18	0.805	2.06

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.607 **Standard Deviation** 0.451 **Maximum** 2.07

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0656	0.1	0.12	0.0525
Box:	0.413	0.289	0.217	2.32

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0961	0.0119	0.0527

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.196	0.0576	0.145

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.208	0.0673	0.156

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00304	**Sash Leakage Area / Face Area**	0.576
Box Leakage / Hood Flow	0.000081	**Box Leakage Area / Box Surface Area**	0.404

Casename run118

Date 11/6/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 684 cfm (17 ACH), Tsup 63°F 17.2°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
As run118; Person 4 inches in front of hood, lights and ductwork recessed into ceiling.

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	48	**Y**	35	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.524	**Standard Deviation**	0.323	**Maximum**	1.66

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.441	1.42	0.481	1.42
Box:	0.926	3.08	0.93	2.89

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.474	**Standard Deviation**	0.501	**Maximum**	3.39

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.238	0.268	0.264	0.0935
Box:	0.51	0.344	0.346	0.725

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.12	0.0153	0.0477

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00638	0.0319
Box:	0.22	0.0953	0.253

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.0865	0.00552	0.0319
Box:	0.239	0.0914	0.28

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0043	**Sash Leakage Area / Face Area**	0.55
Box Leakage / Hood Flow	0.000041	**Box Leakage Area / Box Surface Area**	0.358

Casename run119c

Date 1/3/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 684 cfm (17 ACH), Tsup 63°F 17.2°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
1 off 24" square - layout SM SQ B.1 Hood -783 cfm, Transfer grille SHUT, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser				
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	3	Mwords	**Grid Dimensions:**	**X**	42	**Y**	31	**Z**	35

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.318 **Standard Deviation** 0.288 **Maximum** 1.54

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.347	0.413	0.351	0.413
Box:	0.791	1.93	0.835	2

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.635 **Standard Deviation** 0.427 **Maximum** 1.42

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0406	0.0672	0.27	0.104
Box:	0.235	0.186	0.445	7.45

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0797	0.00355	0.0102

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.18	0.0239	0.119

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.247	0.0447	0.182

Leakage Factor (leakage from a completely contaminated hood)
Sash Leakage / Hood Flow 0.00433 **Sash Leakage Area / Face Area** 0.544
Box Leakage / Hood Flow 0.000167 **Box Leakage Area / Box Surface Area** 0.44

Casename run119

Date 11/6/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 684 cfm (17 ACH), Tsup 63°F 17.2°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
As run119; Person 4 inches in front of hood, lights and ductwork recessed into ceiling

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser				
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	47	**Y**	35	**Z**	35

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.439	**Standard Deviation**	0.273	**Maximum**	1.38

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.461	1.42	0.488	1.42
Box:	0.909	2.86	0.933	2.91

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.493	**Standard Deviation**	0.632	**Maximum**	7.55

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.233	0.249	0.304	0.0829
Box:	0.347	0.264	0.483	0.775

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0478	0.00119	0.00686

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00638	0.0319
Box:	0.148	0.0507	0.23

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.0865	0.00552	0.0319
Box:	0.173	0.0609	0.298

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00562	**Sash Leakage Area / Face Area**	0.594
Box Leakage / Hood Flow	0.000061	**Box Leakage Area / Box Surface Area**	0.441

Casename run120c

Date 1/8/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 684 cfm (17 ACH), Tsup 63°F 17.2°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
1 off Radial - layout SM TAD A.3 Hood -783 cfm, Transfer grille SHUT, door crack 100 cfm

Specialist Devices	TAD			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no				
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	3	Mwords	**Grid Dimensions:**	**X**	37	**Y**	29	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.569	Standard Deviation	0.516	Maximum	2.52

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.333	0.434	0.38	0.525
Box:	0.984	3.02	1.08	2.86

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.612	Standard Deviation	0.426	Maximum	1.65

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0581	0.156	0.245	0.0982
Box:	0.564	0.435	0.522	9.31

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.291	0.0448	0.0648

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.391	0.112	0.232

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.44	0.187	0.349

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00364	**Sash Leakage Area / Face Area**	0.514
Box Leakage / Hood Flow	0.000532	**Box Leakage Area / Box Surface Area**	0.26

Casename run120

Date 11/6/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 684 cfm (17 ACH), Tsup 63°F 17.2°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
As run120; Person 4 inches in front of hood, lighting and ductwork recessed into ceiling

Specialist Devices	TAD			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no				
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	42	**Y**	33	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.733 **Standard Deviation** 0.467 **Maximum** 2.38

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.468	1.42	0.512	1.42
Box:	1.08	3.58	1.22	3.28

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.573 **Standard Deviation** 0.699 **Maximum** 4.43

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.237	0.277	0.328	0.093
Box:	0.576	0.495	0.59	1.22

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.467	0.0665	0.0755

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00638	0.0319
Box:	0.567	0.13	0.23

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.0865	0.00552	0.0319
Box:	0.584	0.178	0.32

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00522	**Sash Leakage Area / Face Area**	0.572
Box Leakage / Hood Flow	0.000089	**Box Leakage Area / Box Surface Area**	0.326

2 off Perforated - layout SM PERF A.1 Hood -783 cfm, Transfer grille SHUT, door crack 100 cfm

Specialist Devices	Perforated diff			Fume hood		Ceiling diffuser							
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no						
Concentration	From hood	**Turbulence**	ke model	**Special**									
Dimensionality	3d Steady	**A-Array Size**	3	Mwords	**Grid Dimensions:**	**X**	37	**Y**	29	**Z**	34		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.429	**Standard Deviation**	0.288	**Maximum**	1.48

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.314	0.403	0.323	0.383
Box:	0.749	1.97	0.802	2.03

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.627	**Standard Deviation**	0.429	**Maximum**	1.49

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0476	0.0564	0.169	0.0653
Box:	0.306	0.248	0.295	3.62

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0631	0.00682	0.0327

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.163	0.0439	0.122

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.19	0.0623	0.166

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00408	**Sash Leakage Area / Face Area**	0.547
Box Leakage / Hood Flow	0.000173	**Box Leakage Area / Box Surface Area**	0.471

Casename run121c

Date 1/3/95

Description

Model Internal
Flow Forced
Application Types Laboratory Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 684 cfm (17 ACH), Tsup 63°F 17.2°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
As run121; Person 4 inches in front of hood, lights and ductwork recessed into ceiling

Specialist Devices	Perforated diff		Fume hood		Ceiling diffuser						
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	50	**Y**	35	**Z**	34

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.528 **Standard Deviation** 0.266 **Maximum** 1.3

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.465	1.42	0.487	1.42
Box:	0.91	3.39	0.935	2.98

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.603 **Standard Deviation** 0.794 **Maximum** 5.26

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.247	0.244	0.313	0.0835
Box:	0.422	0.3	0.455	0.632

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0662	0.00599	0.031

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00638	0.0319
Box:	0.166	0.072	0.255

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.00552	0.0319
Box:	0.191	0.0806	0.288

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0055	**Sash Leakage Area / Face Area**	0.534
Box Leakage / Hood Flow	0.000087	**Box Leakage Area / Box Surface Area**	0.39

4 off 12" square - layout SQ A.1 Hood -783 cfm, door crack 56 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser						
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**		no				
Concentration	From hood		**Turbulence**	ke model		**Special**							
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**		**X**	57	**Y**	48	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.424	**Standard Deviation**	0.271	**Maximum**	1.55

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.324	0.402	0.322	0.371
Box:	0.75	1.74	0.783	1.69

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.639	**Standard Deviation**	0.418	**Maximum**	1.39

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0442	0.0393	0.177	0.061
Box:	0.303	0.19	0.306	2.1

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0695	0.00517	0.0274

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.17	0.0456	0.144

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.159	0.0518	0.169

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00387	**Sash Leakage Area / Face Area**	0.464
Box Leakage / Hood Flow	0.000121	**Box Leakage Area / Box Surface Area**	0.558

Casename run123 Date 11/6/95

Description

Model Internal
Flow Forced
Application Types Laboratory Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 727 cfm (6 ACH), Tsup 55°F 12.8°C, total heat load 5.3 W/ft² (equip 3.0 W/ft²)

Parametric Variation
2 off 24" square - layout SQ B.1 Hood -783 cfm, door crack 56 cfm

Specialist Devices	Square diffuser			Fume hood				Ceiling diffuser			
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5 Mwords	**Grid Dimensions:**	**X** 54	**Y** 46	**Z** 35				

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.301 **Standard Deviation** 0.196 **Maximum** 1.14

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.347	0.407	0.341	0.424
Box:	0.742	1.67	0.751	1.73

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.647 **Standard Deviation** 0.424 **Maximum** 1.43

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0268	0.0209	0.261	0.109
Box:	0.153	0.0966	0.411	4.85

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0	0	0

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0814	0.0148	0.115

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0711	0.0173	0.127

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00409	**Sash Leakage Area / Face Area**	0.555
Box Leakage / Hood Flow	0.000142	**Box Leakage Area / Box Surface Area**	0.678

2 off Radial - layout TAD B.1 Hood -783 cfm, door crack 56 cfm

Specialist Devices	TAD			Fume hood			Ceiling diffuser						
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**		no				
Concentration	From hood		**Turbulence**	ke model		**Special**							
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**		**X**	54	**Y**	46	**Z**	35	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.316	**Standard Deviation**	0.268	**Maximum**	1.34

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.304	0.389	0.305	0.359
Box:	0.677	1.64	0.694	1.88

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.63	**Standard Deviation**	0.408	**Maximum**	1.49

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0329	0.0287	0.132	0.0464
Box:	0.18	0.144	0.19	1.7

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0177	0.00031	0.00343

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.118	0.0176	0.11

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.11	0.0162	0.0963

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00343	**Sash Leakage Area / Face Area**	0.568
Box Leakage / Hood Flow	0.000079	**Box Leakage Area / Box Surface Area**	0.68

Casename run125 Date 11/6/95

Description

Model Internal
Flow Forced
Application Types Laboratory Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 727 cfm (6 ACH), Tsup 55°F 12.8°C, total heat load 5.3 W/ft² (equip 3.0 W/ft²)

Parametric Variation
4 off Perforated - layout PERF A.1 Hood -783 cfm, door crack 56 cfm

Specialist Devices	Perforated diff			Fume hood			Ceiling diffuser				
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5 Mwords	**Grid Dimensions:**	**X**	55	**Y**	49	**Z**	35	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.372 **Standard Deviation** 0.281 **Maximum** 1.62

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.314	0.404	0.321	0.381
Box:	0.719	2.17	0.757	2.06

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.649 **Standard Deviation** 0.442 **Maximum** 1.88

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0367	0.0292	0.155	0.0582
Box:	0.215	0.156	0.265	2.05

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0556	0.0032	0.0209

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.156	0.0313	0.125

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.151	0.0382	0.15

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00392	**Sash Leakage Area / Face Area**	0.586
Box Leakage / Hood Flow	0.000134	**Box Leakage Area / Box Surface Area**	0.564

2 off square - layout SM SQ A.1 Hood -783 cfm, transfer grille 442 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser						
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**		no				
Concentration	From hood		**Turbulence**	ke model		**Special**							
Dimensionality	3d Steady	**A-Array Size**	3	Mwords	**Grid Dimensions:**	**X**	43	**Y**	31	**Z**	34		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.705	**Standard Deviation**	0.627	**Maximum**	2.96

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.375	0.47	0.395	0.47
Box:	0.971	3.14	1.15	2.29

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.64	**Standard Deviation**	0.441	**Maximum**	1.53

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0537	0.126	0.372	0.135
Box:	0.479	0.495	0.674	16

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.365	0.0553	0.0689

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.465	0.109	0.157

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.518	0.169	0.248

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00527	**Sash Leakage Area / Face Area**	0.537
Box Leakage / Hood Flow	0.000986	**Box Leakage Area / Box Surface Area**	0.148

Casename run126c

Date 1/3/95

Description

Model Internal
Flow Forced
Application Types Laboratory Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 242 cfm (6 ACH), Tsup 55°F 12.8°C, total heat load 5.3 W/ft² (equip 3.0 W/ft²)

Parametric Variation
As run126; Person 4 inches in front of hood, lights and ductwork recessed into ceiling

Specialist Devices	Square diffuser		Fume hood		Ceiling diffuser						
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	48	**Y**	35	**Z**	34

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.583 **Standard Deviation** 0.323 **Maximum** 1.72

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.485	1.42	0.523	1.42
Box:	1.01	2.78	1.09	2.68

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.489 **Standard Deviation** 0.705 **Maximum** 9.09

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.235	0.271	0.396	0.0858
Box:	0.439	0.396	0.691	1.19

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.176	0.0115	0.035

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00638	0.0319
Box:	0.276	0.0767	0.247

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.00552	0.0319
Box:	0.37	0.12	0.357

Leakage Factor (leakage from a completely contaminated hood)
Sash Leakage / Hood Flow 0.00709 **Sash Leakage Area / Face Area** 0.569
Box Leakage / Hood Flow 0.000167 **Box Leakage Area / Box Surface Area** 0.221

Casename run127c

Date 1/29/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 242 cfm (6 ACH), Tsup 55°F 12.8°C, total heat load 5.3 W/ft² (equip 3.0 W/ft²)

Parametric Variation
1 off 24" square - layout SM SQ B.1 Hood -783 cfm, transfer grille 442 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood		Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	3 Mwords	**Grid Dimensions:**	**X**	42	**Y**	31	**Z**	35	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.636 **Standard Deviation** 0.451 **Maximum** 2.45

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.432	0.503	0.441	0.507
Box:	1.07	2.88	1.17	2.27

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.625 **Standard Deviation** 0.436 **Maximum** 1.94

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0625	0.0746	0.597	0.235
Box:	0.441	0.394	0.979	27.4

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.3	0.0359	0.0637

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.4	0.0882	0.17

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.48	0.192	0.418

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00705	**Sash Leakage Area / Face Area**	0.529
Box Leakage / Hood Flow	0.0015	**Box Leakage Area / Box Surface Area**	0.323

Casename run127

Date 11/6/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 242 cfm (6 ACH), Tsup 55°F 12.8°C, total heat load 5.3 W/ft² (equip 3.0 W/ft²)

Parametric Variation
As run127; Person 4 inches in front of hood, lighting and ductwork recessed into ceiling

Specialist Devices	Square diffuser		Fume hood		Ceiling diffuser						
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	47	**Y**	35	**Z**	35

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.616	**Standard Deviation**	0.38	**Maximum**	2.07

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.489	1.42	0.525	1.42
Box:	1.1	3.5	1.13	3.14

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.547	**Standard Deviation**	0.691	**Maximum**	3.88

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.234	0.26	0.4	0.0924
Box:	0.541	0.375	0.758	1.27

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.195	0.0144	0.0518

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00638	0.0319
Box:	0.295	0.109	0.329

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.0865	0.00552	0.0319
Box:	0.388	0.189	0.494

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00743	**Sash Leakage Area / Face Area**	0.574
Box Leakage / Hood Flow	0.000193	**Box Leakage Area / Box Surface Area**	0.317

Casename run128c

Date 1/9/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 242 cfm (6 ACH), Tsup 55°F 12.8°C, total heat load 5.3 W/ft² (equip 3.0 W/ft²)

Parametric Variation
1 off Radial - layout SM TAD A.3 Hood -783 cfm, transfer grille 442 cfm, door crack 100 cfm

Specialist Devices	TAD			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no				
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	3	Mwords	**Grid Dimensions:**	**X**	37	**Y**	29	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.607 **Standard Deviation** 0.495 **Maximum** 2.86

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.44	0.518	0.433	0.539
Box:	1.06	2.52	1.13	1.96

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.624 **Standard Deviation** 0.415 **Maximum** 1.43

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0382	0.0403	0.599	0.214
Box:	0.412	0.378	0.985	23.3

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.232	0.0273	0.0544

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.332	0.0775	0.177

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.38	0.173	0.37

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00775	**Sash Leakage Area / Face Area**	0.469
Box Leakage / Hood Flow	0.000706	**Box Leakage Area / Box Surface Area**	0.49

Casename run128

Date 11/6/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 242 cfm (6 ACH), Tsup 55°F 12.8°C, total heat load 5.3 W/ft² (equip 3.0 W/ft²)

Parametric Variation
As run128; Person 4 inches in front of hood, lights and ductwork recessed into ceiling

Specialist Devices	TAD			Fume hood			Ceiling diffuser				
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no			
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5 Mwords	**Grid Dimensions:**	**X**	42	**Y**	33	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.724 **Standard Deviation** 0.469 **Maximum** 3.21

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.524	1.42	0.543	1.42
Box:	1.15	3.33	1.23	2.92

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.537 **Standard Deviation** 0.66 **Maximum** 4.53

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.236	0.255	0.509	0.104
Box:	0.525	0.483	0.966	2.61

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.266	0.0279	0.0463

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00638	0.0319
Box:	0.366	0.101	0.274

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.0865	0.00552	0.0319
Box:	0.418	0.203	0.469

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00869	**Sash Leakage Area / Face Area**	0.508
Box Leakage / Hood Flow	0.000281	**Box Leakage Area / Box Surface Area**	0.426

Casename run129c

Date 1/10/96

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 242 cfm (6 ACH), Tsup 55°F 12.8°C, total heat load 5.3 W/ft² (equip 3.0 W/ft²)

Parametric Variation
As run129; Person 4 inches in front of hood, lighting and ductwork recessed into ceiling

Specialist Devices	Perforated diff		Fume hood		Ceiling diffuser							
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	3	Mwords	**Grid Dimensions:**	**X**	45	**Y**	31	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.818	**Standard Deviation**	0.683	**Maximum**	3.67

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.398	0.463	0.405	0.503
Box:	1.02	3.17	1.23	2.25

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.594	**Standard Deviation**	0.404	**Maximum**	1.37

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0465	0.0904	0.426	0.149
Box:	0.49	0.567	0.714	17.9

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.383	0.0754	0.0715

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.483	0.125	0.142

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.488	0.184	0.243

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00596	**Sash Leakage Area / Face Area**	0.513
Box Leakage / Hood Flow	0.00105	**Box Leakage Area / Box Surface Area**	0.108

Casename run129

Date 11/6/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description

Small laboratory (22 x 11), hood 100 fpm (100%), Supply 242 cfm (6 ACH), Tsup 55°F 12.8°C, total heat load 5.3 W/ft² (equip 3.0 W/ft²)

Parametric Variation

Specialist Devices	Perforated diff			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5 Mwords	**Grid Dimensions:**	**X**	50	**Y**	35	**Z**	34		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean 0.863 **Standard Deviation** 0.687 **Maximum** 3.77

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.468	1.42	0.517	1.42
Box:	1.08	3.49	1.24	3.06

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean 0.53 **Standard Deviation** 0.686 **Maximum** 4.28

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.235	0.278	0.327	0.0905
Box:	0.625	0.609	0.586	0.99

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.396	0.0589	0.0667

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00638	0.0319
Box:	0.496	0.14	0.24

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.00552	0.0319
Box:	0.512	0.183	0.336

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00566	**Sash Leakage Area / Face Area**	0.539
Box Leakage / Hood Flow	0.000111	**Box Leakage Area / Box Surface Area**	0.194

Casename run130c

Date 1/15/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 484 cfm (12 ACH), Tsup 55°F 12.8°C, total heat load 10.3 W/ft² (equip 8.3 W/ft²)

Parametric Variation
As run130; Person 4 inches in front of hood, lighting and ductwork recessed into ceiling

Specialist Devices	Square diffuser		Fume hood		Ceiling diffuser							
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	3	Mwords	**Grid Dimensions:**	**X**	43	**Y**	31	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.569 **Standard Deviation** 0.364 **Maximum** 2.03

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.348	0.437	0.361	0.42
Box:	0.853	2.1	0.952	2.23

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.627 **Standard Deviation** 0.411 **Maximum** 1.38

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0509	0.0519	0.278	0.116
Box:	0.353	0.296	0.475	4.5

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.15	0.015	0.0508

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.25	0.0651	0.161

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.252	0.0904	0.24

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00435	**Sash Leakage Area / Face Area**	0.488
Box Leakage / Hood Flow	0.000217	**Box Leakage Area / Box Surface Area**	0.503

Casename run130

Date 11/6/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description

Small laboratory (22 x 11), hood 100 fpm (100%), Supply 484 cfm (12 ACH), Tsup 55°F 12.8°C, total heat load 10.3 W/ft² (equip 8.3 W/ft²)

Parametric Variation

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**		no			
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5 Mwords	**Grid Dimensions:**	**X**	48	**Y**	35	**Z**	34		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.439	**Standard Deviation**	0.251	**Maximum**	1.15

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.472	1.42	0.493	1.42
Box:	0.917	3.37	0.913	2.94

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.595	**Standard Deviation**	0.838	**Maximum**	6.04

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.24	0.242	0.339	0.0879
Box:	0.372	0.244	0.515	0.682

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0298	0.000522	0.00343

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00638	0.0319
Box:	0.13	0.0568	0.243

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.0865	0.00552	0.0319
Box:	0.107	0.0622	0.295

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00639	**Sash Leakage Area / Face Area**	0.538
Box Leakage / Hood Flow	0.000096	**Box Leakage Area / Box Surface Area**	0.445

Casename run131c

Date 1/8/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 484 cfm (12 ACH), Tsup 55°F 12.8°C, total heat load 10.3 W/ft² (equip 8.3 W/ft²)

Parametric Variation
As run131; Person 4 inches in front of hood, lighting and ductwork recessed into ceiling

Specialist Devices	Square diffuser		Fume hood		Ceiling diffuser							
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	3	Mwords	**Grid Dimensions:**	**X**	42	**Y**	31	**Z**	35	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.49 **Standard Deviation** 0.429 **Maximum** 2.26

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.353	0.401	0.362	0.454
Box:	0.846	2.05	0.932	2.15

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.644 **Standard Deviation** 0.424 **Maximum** 1.61

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0659	0.0775	0.298	0.122
Box:	0.339	0.293	0.49	6.02

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0269	0.00273	0.0283

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.127	0.047	0.168

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.155	0.0731	0.279

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00417	**Sash Leakage Area / Face Area**	0.522
Box Leakage / Hood Flow	0.000214	**Box Leakage Area / Box Surface Area**	0.468

Casename run131

Date 11/6/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description

Small laboratory (22 x 11), hood 100 fpm (100%), Supply 484 cfm (12 ACH), Tsup 55°F 12.8°C, total heat load 10.3 W/ft² (equip 8.3 W/ft²)

Parametric Variation

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**		no			
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	47	**Y**	35	**Z**	35	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean 0.527 **Standard Deviation** 0.311 **Maximum** 1.5

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.447	1.42	0.482	1.42
Box:	0.941	3.46	0.931	3.03

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean 0.519 **Standard Deviation** 0.597 **Maximum** 4.13

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.238	0.251	0.23	0.0778
Box:	0.51	0.304	0.34	0.763

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.128	0.0145	0.0642

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00638	0.0319
Box:	0.228	0.104	0.279

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.0865	0.00552	0.0319
Box:	0.251	0.0987	0.297

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00532	**Sash Leakage Area / Face Area**	0.57
Box Leakage / Hood Flow	0.000061	**Box Leakage Area / Box Surface Area**	0.383

Casename run132c

Date 1/8/96

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 484 cfm (12 ACH), Tsup 55°F 12.8°C, total heat load 10.3 W/ft² (equip 8.3 W/ft²)

Parametric Variation
1 off Radial - layout SM TAD A.3 Hood -783 cfm, transfer grille 200 cfm, door crack 100 cfm

Specialist Devices	TAD			Fume hood		Ceiling diffuser						
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	3 Mwords	**Grid Dimensions:**	**X**	37	**Y**	29	**Z**	34		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.46	**Standard Deviation**	0.35	**Maximum**	1.74

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.359	0.495	0.365	0.494
Box:	0.886	2.12	0.953	2.16

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.627	**Standard Deviation**	0.439	**Maximum**	1.57

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0425	0.0849	0.305	0.0907
Box:	0.372	0.29	0.564	12

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.109	0.0135	0.036

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.209	0.0562	0.175

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.307	0.124	0.278

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00424	**Sash Leakage Area / Face Area**	0.549
Box Leakage / Hood Flow	0.000392	**Box Leakage Area / Box Surface Area**	0.312

Casename run132

Date 11/6/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 484 cfm (12 ACH), Tsup 55°F 12.8°C, total heat load 10.3 W/ft² (equip 8.3 W/ft²)

Parametric Variation
As run132; Person 4 inches in front of hood, lights and ductwork recessed into ceiling

Specialist Devices	TAD			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no				
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	42	**Y**	33	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.584	**Standard Deviation**	0.324	**Maximum**	1.57

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.464	1.42	0.492	1.42
Box:	1.02	3.29	1.07	2.96

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.475	**Standard Deviation**	0.553	**Maximum**	3.21

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.227	0.249	0.32	0.081
Box:	0.492	0.369	0.601	1.01

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.221	0.0275	0.0479

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00638	0.0319
Box:	0.321	0.0921	0.239

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.0865	0.00552	0.0319
Box:	0.383	0.142	0.352

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00589	**Sash Leakage Area / Face Area**	0.604
Box Leakage / Hood Flow	0.000079	**Box Leakage Area / Box Surface Area**	0.376

Casename run133c

Date 1/10/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 484 cfm (12 ACH), Tsup 55°F 12.8°C, total heat load 10.3 W/ft² (equip 8.3 W/ft²)

Parametric Variation
2 off Perforated - layout SM PERF A.1 Hood -783 cfm, transfer grille 200 cfm, door crack 100 cfm

Specialist Devices	Perforated diff			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	3	Mwords	**Grid Dimensions:**	**X**	45	**Y**	31	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.505	Standard Deviation	0.385	Maximum	2.12

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.348	0.431	0.362	0.421
Box:	0.836	2	0.934	2.08

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.646	Standard Deviation	0.434	Maximum	1.89

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0421	0.0409	0.286	0.118
Box:	0.297	0.262	0.499	5.64

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.119	0.00833	0.0295

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.219	0.0477	0.163

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.242	0.0801	0.232

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00451	**Sash Leakage Area / Face Area**	0.581
Box Leakage / Hood Flow	0.000265	**Box Leakage Area / Box Surface Area**	0.546

Casename run133

Date 11/6/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 484 cfm (12 ACH), Tsup 55°F 12.8°C, total heat load 10.3 W/ft² (equip 8.3 W/ft²)

Parametric Variation
As run133; Person 4 inches in front of hood, lighting and ductwork recessed into ceiling.

Specialist Devices	Perforated diff		Fume hood		Ceiling diffuser							
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	50	**Y**	34	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.501	**Standard Deviation**	0.272	**Maximum**	1.18

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.48	1.42	0.508	1.42
Box:	0.986	3.18	1.01	2.88

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.709	**Standard Deviation**	1.88	**Maximum**	16.4

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.24	0.262	0.362	0.147
Box:	0.439	0.288	0.605	0.711

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0778	0.00606	0.0523

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00638	0.0319
Box:	0.178	0.0841	0.26

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.0865	0.00552	0.0319
Box:	0.178	0.111	0.343

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00589	**Sash Leakage Area / Face Area**	0.561
Box Leakage / Hood Flow	0.000094	**Box Leakage Area / Box Surface Area**	0.46

Casename run134c

Date 1/17/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH) Tsup 50°F 10°C, total heat load 10.4 W/ft² (equip 8.1 W/ft²)

Parametric Variation
2 off Square - layout SM SQ A.1 Hood -783 cfm, transfer grille 319 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood		Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	3	Mwords	**Grid Dimensions:**	**X**	43	**Y**	31	**Z**	34

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.386	Standard Deviation	0.312	Maximum	1.82

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.347	0.422	0.349	0.406
Box:	0.78	1.95	0.818	1.91

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.637	Standard Deviation	0.418	Maximum	1.37

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0402	0.0223	0.28	0.111
Box:	0.244	0.17	0.44	3.57

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0556	0.00106	0.00975

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.156	0.0227	0.145

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.15	0.0347	0.182

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0046	**Sash Leakage Area / Face Area**	0.563
Box Leakage / Hood Flow	0.000188	**Box Leakage Area / Box Surface Area**	0.677

Casename run134

Date 11/6/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH) Tsup 50°F 10°C, total heat load 10.4 W/ft² (equip 8.1 W/ft²)

Parametric Variation
AS run134; Person 4 inches in front of hood, lighting and ductwork recessed into ceiling

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	48	**Y**	35	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.465	**Standard Deviation**	0.272	**Maximum**	1.51

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.476	1.42	0.496	1.42
Box:	0.943	3.33	0.954	2.9

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.715	**Standard Deviation**	1.42	**Maximum**	12.3

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.239	0.241	0.341	0.0848
Box:	0.373	0.263	0.542	0.641

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0725	0.0042	0.0277

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00638	0.0319
Box:	0.172	0.0612	0.237

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.0865	0.00552	0.0319
Box:	0.173	0.0741	0.319

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00664	**Sash Leakage Area / Face Area**	0.557
Box Leakage / Hood Flow	0.000104	**Box Leakage Area / Box Surface Area**	0.45

Casename run135c

Date 1/10/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH) Tsup 50°F 10°C, total heat load 10.4 W/ft² (equip 8.1 W/ft²)

Parametric Variation
1 off Square - layout SM SQ B.1 Hood -783 cfm, transfer grille 319 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood		Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	3	Mwords	**Grid Dimensions:**	**X**	42	**Y**	31	**Z**	35

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.636 **Standard Deviation** 0.571 **Maximum** 3.55

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.334	0.462	0.343	0.438
Box:	0.859	2.44	0.992	2.11

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.637 **Standard Deviation** 0.435 **Maximum** 1.35

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0551	0.069	0.244	0.0817
Box:	0.417	0.399	0.416	6.93

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.215	0.0198	0.0369

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.315	0.0645	0.169

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.36	0.0987	0.239

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00386	**Sash Leakage Area / Face Area**	0.561
Box Leakage / Hood Flow	0.000465	**Box Leakage Area / Box Surface Area**	0.168

Casename run135

Date 11/6/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH) Tsup 50°F 10°C, total heat load 10.4 W/ft² (equip 8.1 W/ft²)

Parametric Variation
As run135; Person 4 inches in front of hood, lighting and ductwork recessed into ceiling

Specialist Devices	Square diffuser		Fume hood		Ceiling diffuser						
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	35	Mwords	**Grid Dimensions:**	**X**	47	**Y**	35	**Z**	35

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.651	**Standard Deviation**	0.48	**Maximum**	3.29

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.468	1.42	0.496	1.42
Box:	1	3.45	1.07	3.04

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.539	**Standard Deviation**	0.621	**Maximum**	4.18

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.242	0.25	0.301	0.0873
Box:	0.496	0.425	0.54	1.01

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0767	0.0106	0.0585

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00638	0.0319
Box:	0.177	0.0936	0.28

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.0865	0.00552	0.0319
Box:	0.238	0.125	0.338

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00584	**Sash Leakage Area / Face Area**	0.554
Box Leakage / Hood Flow	0.00012	**Box Leakage Area / Box Surface Area**	0.443

Casename run136c

Date 1/12/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH) Tsup 50°F 10°C, total heat load 10.4 W/ft² (equip 8.1 W/ft²)

Parametric Variation
1 off Radial - layout SM TAD A.3 Hood -783 cfm, transfer grille 319 cfm, door crack 100 cfm

Specialist Devices	TAD			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no				
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	3	Mwords	**Grid Dimensions:**	**X**	37	**Y**	29	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.542	Standard Deviation	0.45	Maximum	2.51

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.332	0.444	0.343	0.45
Box:	0.824	2.2	0.941	2.06

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.656	Standard Deviation	0.443	Maximum	1.7

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0436	0.0954	0.185	0.0787
Box:	0.36	0.355	0.416	10.6

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.154	0.0178	0.0584

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.254	0.0645	0.144

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.312	0.11	0.21

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00387	**Sash Leakage Area / Face Area**	0.532
Box Leakage / Hood Flow	0.00041	**Box Leakage Area / Box Surface Area**	0.209

Casename run136

Date 11/6/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH) Tsup 50°F 10°C, total heat load 10.4 W/ft² (equip 8.1 W/ft²)

Parametric Variation
As run136, Person 4 inches in front of hood, lighting and ductwork recessed into ceiling

Specialist Devices	TAD			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no				
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	42	**Y**	33	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.55	**Standard Deviation**	0.292	**Maximum**	1.62

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.473	1.42	0.49	1.42
Box:	0.956	3.15	1.01	2.83

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.464	**Standard Deviation**	0.443	**Maximum**	1.8

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.238	0.244	0.343	0.0852
Box:	0.41	0.329	0.595	1.11

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.133	0.0115	0.0372

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00638	0.0319
Box:	0.233	0.0723	0.211

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.0865	0.00552	0.0319
Box:	0.295	0.116	0.292

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00566	**Sash Leakage Area / Face Area**	0.568
Box Leakage / Hood Flow	0.000108	**Box Leakage Area / Box Surface Area**	0.29

Casename run137

Date 11/6/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH) Tsup 50°F 10°C, total heat load 10.4 W/ft² (equip 8.1 W/ft²)

Parametric Variation
2 off Perforated - layout SM PERF A.1 Hood -783 cfm, transfer grille 319 cfm, door crack 100 cfm

Specialist Devices	Perforated diff			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	3	Mwords	**Grid Dimensions:**	**X**	45	**Y**	31	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.478 **Standard Deviation** 0.398 **Maximum** 2.4

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.371	0.441	0.378	0.472
Box:	0.882	1.91	0.947	2.16

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.628 **Standard Deviation** 0.437 **Maximum** 1.55

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0423	0.0502	0.352	0.125
Box:	0.362	0.249	0.593	9.07

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0479	0.00285	0.0237

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.148	0.0424	0.171

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.188	0.088	0.286

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00499	**Sash Leakage Area / Face Area**	0.5
Box Leakage / Hood Flow	0.000334	**Box Leakage Area / Box Surface Area**	0.568

Casename run137c

Date 1/15/96

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH) Tsup 50°F 10°C, total heat load 10.4 W/ft² (equip 8.1 W/ft²)

Parametric Variation
As run137; Person 4 inches in front of hood, lighting and ductwork recessed into ceiling

Specialist Devices	Perforated diff		Fume hood		Ceiling diffuser							
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	50	**Y**	35	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.527	**Standard Deviation**	0.38	**Maximum**	2.57

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.482	1.42	0.511	1.42
Box:	1.01	3.34	1.03	2.92

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.496	**Standard Deviation**	0.568	**Maximum**	3.87

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.231	0.244	0.388	0.0882
Box:	0.473	0.327	0.631	1.44

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0341	0.00184	0.0212

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00638	0.0319
Box:	0.134	0.0732	0.292

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.0865	0.00552	0.0319
Box:	0.207	0.123	0.437

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00723	**Sash Leakage Area / Face Area**	0.536
Box Leakage / Hood Flow	0.000142	**Box Leakage Area / Box Surface Area**	0.459

Casename run138

Date 11/6/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off square - layout SM SQ A.1 Hood position 3 Hood -783 cfm, Transfer grille 319 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser		
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**		no
Concentration	From hood		**Turbulence**	ke model	**Special**				
Dimensionality	3d Steady	**A-Array Size**		Mwords	**Grid Dimensions:**	**X**	**Y**	**Z**	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.78 **Standard Deviation** 0.51 **Maximum** 2.89

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.342	0.454	0.347	0.412
Box:	0.897	2.4	1.05	1.72

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.627 **Standard Deviation** 0.387 **Maximum** 1.65

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0736	0.0906	0.228	0.0785
Box:	0.548	0.499	0.463	3.7

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.214	0.0335	0.075

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.314	0.102	0.21

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.331	0.136	0.255

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00482	**Sash Leakage Area / Face Area**	0.426
Box Leakage / Hood Flow	0.000281	**Box Leakage Area / Box Surface Area**	0.499

Casename run139

Date 11/6/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off square - layout SM SQ A.1 BULKHEAD Hood -783 cfm, Transfer grille 319 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood		Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	3 Mwords	**Grid Dimensions:**	**X**	43	**Y**	31	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.392 **Standard Deviation** 0.486 **Maximum** 2.67

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.334	0.433	0.338	0.405
Box:	0.785	1.83	0.844	2

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.633 **Standard Deviation** 0.437 **Maximum** 1.58

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0573	0.0787	0.225	0.0809
Box:	0.316	0.272	0.373	3.14

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0839	0.0037	0.0135

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.184	0.0328	0.146

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.195	0.0453	0.164

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0039	**Sash Leakage Area / Face Area**	0.528
Box Leakage / Hood Flow	0.000113	**Box Leakage Area / Box Surface Area**	0.532

Casename run139c

Date 1/29/96

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
As run139; Person four inches in front of hood, lighting and ductwork recessed into ceiling

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**		no			
Concentration	From hood	**Turbulence**		ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	48	**Y**	34	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.55 **Standard Deviation** 0.406 **Maximum** 2.31

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.46	1.42	0.491	1.42
Box:	0.925	3.04	0.975	2.64

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.507 **Standard Deviation** 0.592 **Maximum** 3.8

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.236	0.256	0.281	0.172
Box:	0.435	0.347	0.447	0.658

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.112	0.0059	0.0277

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00638	0.0319
Box:	0.212	0.0741	0.248

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.00552	0.0319
Box:	0.226	0.0874	0.289

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00502	**Sash Leakage Area / Face Area**	0.551
Box Leakage / Hood Flow	0.000063	**Box Leakage Area / Box Surface Area**	0.402

Casename run140c

Date 1/15/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
As run140, Person 4 inches in front of hood, lighting and ductwork recessed into ceiling

1 off square layout SW SC 3 ft BULKHEAD Hood 783 cfm Transfer grille 319 cfm door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	3	Mwords	**Grid Dimensions:**	**X**	42	**Y**	31	**Z**	35	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.643	Standard Deviation	0.585	Maximum	3.59

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.32	0.468	0.328	0.433
Box:	0.83	2.51	0.967	2.09

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.633	Standard Deviation	0.435	Maximum	1.45

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0522	0.0616	0.211	0.0669
Box:	0.41	0.409	0.353	5.46

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.232	0.0218	0.0369

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.332	0.0641	0.185

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.372	0.0901	0.207

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00354	**Sash Leakage Area / Face Area**	0.597
Box Leakage / Hood Flow	0.000413	**Box Leakage Area / Box Surface Area**	0.169

Casename run140

Date 11/6/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5 Mwords	**Grid Dimensions:**	**X**	47	**Y**	35	**Z**	35		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.689	Standard Deviation	0.522	Maximum	3.37

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.46	1.42	0.49	1.42
Box:	0.992	3.45	1.08	3.03

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.575	Standard Deviation	0.817	Maximum	6.69

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.246	0.251	0.272	0.0836
Box:	0.511	0.457	0.463	0.803

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.219	0.016	0.0732

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00638	0.0319
Box:	0.319	0.1	0.279

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.00552	0.0319
Box:	0.367	0.124	0.319

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0052	**Sash Leakage Area / Face Area**	0.57
Box Leakage / Hood Flow	0.000088	**Box Leakage Area / Box Surface Area**	0.233

Casename run141c

Date 1/17/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
As run140, Persons 4 inches in front of hood, lighting and ductwork recessed into ceiling

1 off perforated, layout SA4 PERF A1 BULKHEAD Hood 783 cfm, Transfer grille 319 cfm, door crack 100 cfm

Specialist Devices	Perforated diff			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	3	Mwords	**Grid Dimensions:**	**X**	45	**Y**	31	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.421	Standard Deviation	0.445	Maximum	2.74

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.362	0.434	0.365	0.444
Box:	0.842	1.85	0.919	2.04

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.633	Standard Deviation	0.44	Maximum	1.47

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0403	0.0568	0.325	0.111
Box:	0.323	0.272	0.55	8.91

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.00246	0.0000465	0.0037

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.102	0.0271	0.14

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.133	0.0672	0.259

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00467	**Sash Leakage Area / Face Area**	0.544
Box Leakage / Hood Flow	0.000227	**Box Leakage Area / Box Surface Area**	0.584

Casename run141

Date 11/6/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation

Specialist Devices	Perforated diff			Fume hood		Ceiling diffuser						
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	3 Mwords	**Grid Dimensions:**	**X**	45	**Y**	31	**Z**	34		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.591	Standard Deviation	0.407	Maximum	2.79

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.466	1.42	0.499	1.42
Box:	0.98	3.27	1.01	2.87

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.485	Standard Deviation	0.553	Maximum	3.67

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.231	0.25	0.324	0.0851
Box:	0.503	0.374	0.512	0.888

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0988	0.00769	0.0233

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00638	0.0319
Box:	0.199	0.0828	0.277

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.00552	0.0319
Box:	0.252	0.113	0.374

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00598	**Sash Leakage Area / Face Area**	0.564
Box Leakage / Hood Flow	0.000098	**Box Leakage Area / Box Surface Area**	0.429

Casename run143

Date 11/6/95

Description

Model Internal
Flow Forced
Application Types Laboratory Fume hood
Case Description

5.7 W/ft²)
Parametric Variation
4 off square 12" layout SQ A.1 - Trunk exhaust moved Hood -783 cfm, Trunk exhaust -413 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser				
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	61	**Y**	48	**Z**	34

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.51 **Standard Deviation** 0.401 **Maximum** 2.17

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.292	0.416	0.301	0.375
Box:	0.712	1.76	0.801	1.77

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.636 **Standard Deviation** 0.41 **Maximum** 1.25

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0474	0.0595	0.155	0.0567
Box:	0.348	0.275	0.235	1.69

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0799	0.00715	0.0356

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.18	0.0533	0.16

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.148	0.0589	0.182

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00311	**Sash Leakage Area / Face Area**	0.503
Box Leakage / Hood Flow	0.000105	**Box Leakage Area / Box Surface Area**	0.545

Casename run142

Date 11/6/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description

Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F 12.8°C, heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation

2 off square - layout SQ B.1, Trunk exhaust moved Hood -783 cfm, Trunk exhaust -413 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser				
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	58	**Y**	46	**Z**	35

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean 0.349 **Standard Deviation** 0.224 **Maximum** 1.11

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.341	0.383	0.341	0.42
Box:	0.767	1.97	0.786	1.99

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean 0.65 **Standard Deviation** 0.435 **Maximum** 1.56

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0284	0.0385	0.242	0.0966
Box:	0.218	0.136	0.406	4.61

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0545	0.0021	0.0135

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.155	0.0281	0.116

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.189	0.0387	0.149

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00418	**Sash Leakage Area / Face Area**	0.469
Box Leakage / Hood Flow	0.000151	**Box Leakage Area / Box Surface Area**	0.579

Casename run144

Date 11/6/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off Radial - layout TAD B.1, trunk exhaust moved Hood -783 cfm, trunk exhaust -413 cfm, door crack 100 cfm

Specialist Devices	TAD			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no				
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	55	**Y**	45	**Z**	33	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.35	Standard Deviation	0.268	Maximum	1.27

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.318	0.409	0.322	0.38
Box:	0.711	1.78	0.734	1.98

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.635	Standard Deviation	0.419	Maximum	1.49

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.029	0.0224	0.162	0.0677
Box:	0.227	0.164	0.245	2.18

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0233	0.00069	0.00686

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.123	0.0263	0.145

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.102	0.0291	0.148

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00387	**Sash Leakage Area / Face Area**	0.537
Box Leakage / Hood Flow	0.000122	**Box Leakage Area / Box Surface Area**	0.702

Casename run145

Date 11/6/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F 12.8°C, heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
4 off perforated - layout PERF A.1, trunk exhaust moved Hood -783 cfm, Trunk exhaust -413 cfm, door crack 100 cfm

Specialist Devices	Perforated diff			Fume hood		Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	59	**Y**	49	**Z**	35

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.501	**Standard Deviation**	0.402	**Maximum**	2.31

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.321	0.411	0.323	0.389
Box:	0.78	2.33	0.853	1.86

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.62	**Standard Deviation**	0.393	**Maximum**	1.42

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0621	0.068	0.166	0.0524
Box:	0.351	0.267	0.298	2.01

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.208	0.0203	0.0414

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.308	0.0658	0.17

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.289	0.0764	0.178

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00407	**Sash Leakage Area / Face Area**	0.514
Box Leakage / Hood Flow	0.000124	**Box Leakage Area / Box Surface Area**	0.564

Casename run146

Date 11/6/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description

Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F 12.8°C, heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation

2 off radial - layout TAD B.3a, Person 4 inches from hood Hood -783 cfm, Trunk exhaust -413 cfm, door crack 100 cfm

Specialist Devices	TAD			Fume hood		Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no			
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	54	**Y**	56	**Z**	39

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean 0.471 **Standard Deviation** 0.244 **Maximum** 1.26

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.471	1.49	0.474	1.49
Box:	1.06	2.7	1.09	2.69

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean 0.569 **Standard Deviation** 0.642 **Maximum** 6.05

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.232	0.225	0.399	1.01
Box:	0.34	0.286	0.793	5.1

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0714	0.00258	0.0199

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00137	0.00685
Box:	0.171	0.0741	0.25

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.231	0.0031	0.00685
Box:	0.228	0.147	0.406

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0193	**Sash Leakage Area / Face Area**	0.598
Box Leakage / Hood Flow	0.00037	**Box Leakage Area / Box Surface Area**	0.458

Casename run147

Date 11/6/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Large laboratory (33 x 22), hood 100 fpm (100%), Supply 1097 cfm (9.1 ACH), Tsup 55°F 12.8°C, heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off radial - layout TAD B.1, Person 4 inches from hood Hood -783 cfm, Trunk exhaust -413 cfm, door crack 100 cfm

Specialist Devices	TAD			Fume hood		Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no			
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	56	**Y**	57	**Z**	39

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.445	**Standard Deviation**	0.283	**Maximum**	1.23

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.426	1.46	0.43	1.46
Box:	0.916	3.09	0.893	2.9

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.618	**Standard Deviation**	0.78	**Maximum**	5.75

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.232	0.215	0.208	0.957
Box:	0.379	0.251	0.287	3.1

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0582	0.00207	0.0169

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00137	0.00685
Box:	0.158	0.0814	0.298

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.175	0.00233	0.00685
Box:	0.147	0.0793	0.297

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0133	**Sash Leakage Area / Face Area**	0.592
Box Leakage / Hood Flow	0.00012	**Box Leakage Area / Box Surface Area**	0.327

Casename run148

Date 11/6/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F 12.8°C, heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off square - layout SM SQ A.1, Person 4 inches from hood Hood -783 cfm, Transfer grill 319 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood		Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	49	**Y**	35	**Z**	40

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.551	Standard Deviation	0.457	Maximum	2.32

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.428	1.42	0.459	1.42
Box:	0.978	3.23	1	2.88

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.644	Standard Deviation	0.953	Maximum	6.8

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.22	0.248	0.271	0.0533
Box:	0.475	0.349	0.423	0.644

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.103	0.00677	0.0472

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00137	0.00685
Box:	0.203	0.0925	0.287

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.00119	0.00685
Box:	0.201	0.0963	0.344

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00651	**Sash Leakage Area / Face Area**	0.615
Box Leakage / Hood Flow	0.000060	**Box Leakage Area / Box Surface Area**	0.477

Casename run149

Date 11/6/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F 12.8°C, heat load 8 W/ft² (equip 5.7 W/ft²)
Parametric Variation
4 off square - layout SM SQ A.2, Person 4 inches from hood Hood -783 cfm, Transfer grille 319 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood		Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	49	**Y**	36	**Z**	40

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.525 **Standard Deviation** 0.383 **Maximum** 2.25

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.45	1.42	0.476	1.42
Box:	1.01	2.96	1.07	2.7

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.588 **Standard Deviation** 0.693 **Maximum** 5.18

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.226	0.252	0.347	1.08
Box:	0.421	0.391	0.582	2.54

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0355	0.00103	0.0266

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00137	0.00685
Box:	0.135	0.081	0.288

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.00119	0.00685
Box:	0.18	0.12	0.385

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0161	**Sash Leakage Area / Face Area**	0.579
Box Leakage / Hood Flow	0.000199	**Box Leakage Area / Box Surface Area**	0.366

Casename run151

Date 11/27/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F 12.8°C, heat load 8 W/ft² (equip 5.7 W/ft²)
Parametric Variation

Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no				
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	48	**Y**	35	**Z**	41	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.685 **Standard Deviation** 0.546 **Maximum** 3.49

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.428	1.42	0.468	1.42
Box:	1.03	3.37	1.12	3.08

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.669 **Standard Deviation** 1.22 **Maximum** 15.6

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.228	0.259	0.259	0.0693
Box:	0.514	0.47	0.457	0.841

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.188	0.0155	0.085

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00137	0.00685
Box:	0.288	0.112	0.274

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.00119	0.00685
Box:	0.341	0.128	0.371

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00594	**Sash Leakage Area / Face Area**	0.574
Box Leakage / Hood Flow	0.000083	**Box Leakage Area / Box Surface Area**	0.259

Casename run150

Date 11/27/95

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description

Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F 12.8°C, heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation

1 off square - layout SM SQ B.3 1 person 4 inches from hood Hood 783 cfm, Transfer 319 cfm, door crack 100 cfm

Specialist Devices	Square diffuser		Fume hood		Ceiling diffuser							
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	46	**Y**	35	**Z**	39	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean 0.609 **Standard Deviation** 0.319 **Maximum** 1.68

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.44	1.42	0.478	1.42
Box:	1.03	2.95	1.05	2.64

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean 0.553 **Standard Deviation** 0.618 **Maximum** 4.09

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.228	0.271	0.335	0.0618
Box:	0.523	0.396	0.523	1.12

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0886	0.00782	0.0498

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00137	0.00685
Box:	0.189	0.0973	0.31

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.00119	0.00685
Box:	0.221	0.123	0.408

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00655	**Sash Leakage Area / Face Area**	0.6
Box Leakage / Hood Flow	0.000093	**Box Leakage Area / Box Surface Area**	0.429

Casename run153

Date 4/17/96

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description

Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F 12.8°C, heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation

Specialist Devices	TAD			Fume hood		Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5 Mwords	**Grid Dimensions:**	**X**	43	**Y**	33	**Z**	40	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean 0.688 **Standard Deviation** 0.458 **Maximum** 2.01

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.451	1.42	0.485	1.42
Box:	1.08	3.54	1.15	3.3

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean 0.665 **Standard Deviation** 0.916 **Maximum** 7.72

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.228	0.258	0.348	0.0716
Box:	0.56	0.469	0.592	1.22

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.134	0.0233	0.1

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00137	0.00685
Box:	0.234	0.122	0.27

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.0865	0.00119	0.00685
Box:	0.277	0.171	0.363

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00642	**Sash Leakage Area / Face Area**	0.555
Box Leakage / Hood Flow	0.0001	**Box Leakage Area / Box Surface Area**	0.315

Casename run152

Date 11/27/95

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F 12.8°C, heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off square - layout SMTAQ A.3, Person 4 inches from hood Hood - 783 cfm, Transfer grille 319 cfm, door crack 100 cfm

Specialist Devices	Square diffuser		Fume hood		Ceiling diffuser						
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	55	**Y**	33	**Z**	34

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.677	**Standard Deviation**	0.33	**Maximum**	2

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.452	1.42	0.471	1.42
Box:	0.882	2.92	0.952	2.52

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.626	**Standard Deviation**	0.896	**Maximum**	5.38

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.265	0.273	0.215	0.0948
Box:	0.529	0.442	0.299	0.768

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.175	0.0151	0.0392

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00638	0.0319
Box:	0.275	0.095	0.297

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.00552	0.0319
Box:	0.259	0.089	0.271

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0035	**Sash Leakage Area / Face Area**	0.559
Box Leakage / Hood Flow	0.000036	**Box Leakage Area / Box Surface Area**	0.36

Casename run154

Date 4/17/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description

Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F 12.8°C, heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation

1 off Radial - layout SM TAD A.1b hood posn 3, Person 4 inches from hood Hood -783 cfm, Transfer grill 319 cfm, door crack 100 cfm

Specialist Devices	TAD			Fume hood		Ceiling diffuser						
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	45	**Y**	36	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean 0.688 **Standard Deviation** 0.314 **Maximum** 1.85

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.509	1.42	0.532	1.42
Box:	1.11	2.83	1.21	2.5

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean 0.486 **Standard Deviation** 0.641 **Maximum** 5.29

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.232	0.256	0.49	0.0973
Box:	0.536	0.429	0.888	2.58

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.306	0.0428	0.0687

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00695	0.0347
Box:	0.406	0.113	0.26

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.00601	0.0347
Box:	0.445	0.192	0.435

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0078	**Sash Leakage Area / Face Area**	0.562
Box Leakage / Hood Flow	0.000292	**Box Leakage Area / Box Surface Area**	0.491

Casename run155

Date 4/17/96

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F 12.8°C, heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off Square - layout SM SQ A.1 hood posn 3, Person 4 inches from hood Hood -783 cfm, Transfer grill 319 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood				Ceiling diffuser			
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5 Mwords	**Grid Dimensions:**	**X** 51	**Y** 39	**Z** 34				

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.789	**Standard Deviation**	0.432	**Maximum**	2.4

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.481	1.42	0.499	1.42
Box:	0.959	2.79	1.09	2.48

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.81	**Standard Deviation**	2.45	**Maximum**	20.9

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.275	0.291	0.293	0.0795
Box:	0.565	0.496	0.421	0.717

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.215	0.0463	0.0838

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00455	0.0227
Box:	0.315	0.124	0.258

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.0865	0.00393	0.0227
Box:	0.325	0.133	0.23

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00491	**Sash Leakage Area / Face Area**	0.542
Box Leakage / Hood Flow	0.000105	**Box Leakage Area / Box Surface Area**	0.414

Casename run156i

Date 4/17/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), 2 hoods D 1 100 fpm (100%), Supply 1100 cfm (27.3 ACH), Tsup 61°F 16.0°C, heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off Square - layout SM SQ B.4 Hood (each) -783 cfm, Transfer grill 367 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood		Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5 Mwords	**Grid Dimensions:**	**X**	70	**Y**	35	**Z**	35	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.638 **Standard Deviation** 0.175 **Maximum** 0.997

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.49	1.42	0.699	1.42
Box:	1.03	2.83	1.03	1.54

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.565 **Standard Deviation** 1.23 **Maximum** 17.5

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.227	0.568	0.431	0.0909
Box:	0.458	0.695	0.735	1.56

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.1	0.00297	0.014

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00638	0.0319
Box:	0.2	0.0723	0.285

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.00552	0.0319
Box:	0.248	0.119	0.41

Leakage Factor (leakage from a completely contaminated hood)
Sash Leakage / Hood Flow 0.00747 **Sash Leakage Area / Face Area** 0.532
Box Leakage / Hood Flow 0.000142 **Box Leakage Area / Box Surface Area** 0.43

Casename run156ii

Date 4/17/96

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Second hood results

Parametric Variation

Specialist Devices

Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no		
Concentration		**Turbulence**			**Special**				
Dimensionality	3d Steady	**A-Array Size**	Mwords	**Grid Dimensions:**	**X**	**Y**	**Z**		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.638 **Standard Deviation** 0.176 **Maximum** 0.997

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.465	1.42	0.68	1.42
Box:	0.993	3.36	0.979	1.5

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.593 **Standard Deviation** 0.78 **Maximum** 5.3

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.235	0.569	0.333	0.0837
Box:	0.458	0.695	0.59	0.789

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0963	0.00514	0.0239

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00638	0.0319
Box:	0.196	0.0807	0.258

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.0865	0.00552	0.0319
Box:	0.228	0.122	0.382

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00591	**Sash Leakage Area / Face Area**	0.572
Box Leakage / Hood Flow	0.000074	**Box Leakage Area / Box Surface Area**	0.483

Casename run157i

Date 4/17/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), 2 hoods D 1 100 fpm (100%), supply 1400 cfm (34.7 ACH), Tsup 63°F 17.3°C, heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off Square - layout SM SQ B.4 Hood (each) -783 cfm, Transfer grill 66 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood		Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	70	**Y**	35	**Z**	35

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.467	Standard Deviation	0.244	Maximum	1.01

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.479	1.42	0.51	1.42
Box:	0.997	3.08	1.01	2.72

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.658	Standard Deviation	1.41	Maximum	12.9

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.235	0.267	0.352	0.0857
Box:	0.408	0.285	0.622	1.08

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0556	0.00401	0.0331

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00638	0.0319
Box:	0.156	0.0739	0.261

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.00552	0.0319
Box:	0.174	0.107	0.348

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00676	**Sash Leakage Area / Face Area**	0.592
Box Leakage / Hood Flow	0.000098	**Box Leakage Area / Box Surface Area**	0.417

Casename run157ii

Date 4/17/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Second hood results

Parametric Variation

Specialist Devices

Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no		
Concentration	From hood	**Turbulence**	ke model	**Special**					
Dimensionality	3d Steady	**A-Array Size**	Mwords	**Grid Dimensions:**	**X**	**Y**	**Z**		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.527 **Standard Deviation** 0.243 **Maximum** 1.38

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.496	1.42	0.523	1.42
Box:	0.996	2.89	1.03	2.5

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.556 **Standard Deviation** 0.794 **Maximum** 4.98

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.245	0.264	0.429	0.0956
Box:	0.406	0.33	0.713	1.3

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.12	0.00636	0.029

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00638	0.0319
Box:	0.22	0.067	0.246

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.00552	0.0319
Box:	0.236	0.0974	0.347

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00761	**Sash Leakage Area / Face Area**	0.55
Box Leakage / Hood Flow	0.00015	**Box Leakage Area / Box Surface Area**	0.451

Casename run158i

Date 4/17/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), 2 hoods D 2 100 fpm (100%), Supply 1100 cfm (27.3 ACH), Tsup 61°F 16.0°C, heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off Square - layout SM SQ B.4 Hood (each) -783 cfm, Transfer grill 367 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood		Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5 Mwords	**Grid Dimensions:**	**X**	73	**Y**	35	**Z**	35	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.482	Standard Deviation	0.254	Maximum	1.36

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.5	1.42	0.528	1.42
Box:	1.05	3.17	1.08	2.81

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.638	Standard Deviation	1.01	Maximum	8.21

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.234	0.263	0.454	0.0986
Box:	0.398	0.303	0.809	1.81

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.11	0.0056	0.0293

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00638	0.0319
Box:	0.21	0.065	0.224

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.00552	0.0319
Box:	0.261	0.122	0.455

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00792	**Sash Leakage Area / Face Area**	0.554
Box Leakage / Hood Flow	0.00018	**Box Leakage Area / Box Surface Area**	0.454

Casename run158ii

Date 4/17/96

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Second hood results

Parametric Variation

Specialist Devices

Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no	
Concentration	From hood	**Turbulence**	ke model	**Special**					
Dimensionality	3d Steady	**A-Array Size**	Mwords	**Grid Dimensions:**	**X**	**Y**	**Z**		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.572	**Standard Deviation**	0.378	**Maximum**	2.24

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.487	1.42	0.514	1.42
Box:	1.07	2.75	1.1	2.6

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.628	**Standard Deviation**	1.11	**Maximum**	8.38

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.237	0.259	0.386	0.0862
Box:	0.497	0.36	0.719	1.71

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.064	0.00413	0.0293

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00532	0.0266
Box:	0.164	0.089	0.302

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.0865	0.0046	0.0266
Box:	0.208	0.157	0.444

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00724	**Sash Leakage Area / Face Area**	0.567
Box Leakage / Hood Flow	0.000137	**Box Leakage Area / Box Surface Area**	0.416

Casename run159ii

Date 4/17/96

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Second hood results

Parametric Variation

2 off Square - layout SM SQ B.4 (with blanking) Hood (each) -783 cfm, Transfer grill 367 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**		no			
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	73	**Y**	35	**Z**	35	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.646 **Standard Deviation** 0.372 **Maximum** 1.96

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.483	1.42	0.524	1.42
Box:	1.07	3.13	1.13	3

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.541 **Standard Deviation** 0.682 **Maximum** 4.34

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.23	0.28	0.376	0.102
Box:	0.545	0.444	0.746	1.37

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.115	0.0101	0.0531

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00638	0.0319
Box:	0.215	0.0936	0.269

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.0865	0.00552	0.0319
Box:	0.249	0.153	0.417

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00606	**Sash Leakage Area / Face Area**	0.488
Box Leakage / Hood Flow	0.000149	**Box Leakage Area / Box Surface Area**	0.44

Casename run159i

Date 4/17/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), 2 hoods D 2 100 fpm (100%), Supply 1100 cfm (27.3 ACH), Tsup 61°F 16.0°C, heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation

Specialist Devices

Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no	
Concentration	From hood	**Turbulence**	ke model	**Special**					
Dimensionality	3d Steady	**A-Array Size**	Mwords	**Grid Dimensions:**	**X**	**Y**	**Z**		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.586 **Standard Deviation** 0.356 **Maximum** 2.03

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.484	1.42	0.493	1.42
Box:	0.945	3.06	0.998	2.78

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.527 **Standard Deviation** 0.484 **Maximum** 2.42

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.259	0.24	0.326	0.0726
Box:	0.449	0.348	0.499	0.709

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.111	0.0128	0.0533

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00532	0.0266
Box:	0.211	0.0825	0.261

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.0046	0.0266
Box:	0.201	0.0942	0.271

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00587	**Sash Leakage Area / Face Area**	0.548
Box Leakage / Hood Flow	0.000122	**Box Leakage Area / Box Surface Area**	0.337

Casename run160ii

Date 4/17/96

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Second hood results

Parametric Variation

2 off Square - layout SM SQ B.4 Hood (each) -783 cfm, Transfer grille 66 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**		no			
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	73	**Y**	35	**Z**	35	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.545	**Standard Deviation**	0.275	**Maximum**	1.18

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.479	1.42	0.515	1.42
Box:	1	3.09	1.02	2.73

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.634	**Standard Deviation**	1.38	**Maximum**	12.6

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.24	0.272	0.348	0.0809
Box:	0.468	0.335	0.576	0.906

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.112	0.00772	0.0515

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00638	0.0319
Box:	0.212	0.0888	0.265

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.0865	0.00552	0.0319
Box:	0.188	0.119	0.352

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00669	**Sash Leakage Area / Face Area**	0.6
Box Leakage / Hood Flow	0.000099	**Box Leakage Area / Box Surface Area**	0.454

Casename run160i

Date 4/17/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), 2 hoods D 2 100 fpm (100%), supply 1400 cfm (34.7 ACH), Tsup 63°F 17.3°C, heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation

Specialist Devices

Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no			
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	Mwords	**Grid Dimensions:**	**X**	73	**Y**		**Z**		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.591	Standard Deviation	0.291	Maximum	1.44

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.483	1.42	0.5	1.42
Box:	0.974	2.82	1.02	2.63

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.486	Standard Deviation	0.455	Maximum	2.24

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.254	0.254	0.341	0.0753
Box:	0.441	0.368	0.569	0.611

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.143	0.0082	0.0424

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00532	0.0266
Box:	0.243	0.0818	0.283

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.0046	0.0266
Box:	0.257	0.0995	0.33

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00632	**Sash Leakage Area / Face Area**	0.581
Box Leakage / Hood Flow	0.000099	**Box Leakage Area / Box Surface Area**	0.449

Casename run161ii

Date 4/17/96

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Second hood results

Parametric Variation

2 off Square - layout SM SQ B.4 (part blanked) Hood (each) -783 cfm, Transfer grille 66 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**		no			
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	73	**Y**	35	**Z**	35	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.795	**Standard Deviation**	0.525	**Maximum**	3.42

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.487	1.42	0.52	1.42
Box:	1.04	2.77	1.17	2.61

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.596	**Standard Deviation**	0.667	**Maximum**	3.41

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.259	0.288	0.355	0.0809
Box:	0.606	0.529	0.566	0.827

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.224	0.0445	0.109

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00638	0.0319
Box:	0.324	0.131	0.248

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.0865	0.00552	0.0319
Box:	0.324	0.165	0.283

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00565	**Sash Leakage Area / Face Area**	0.522
Box Leakage / Hood Flow	0.00013	**Box Leakage Area / Box Surface Area**	0.418

Casename run161i

Date 4/17/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), 2 hoods D 2 100 fpm (100%), supply 1400 cfm (34.7 ACH), Tsup 63°F 17.3°C, heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation

Specialist Devices

Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no	
Concentration	From hood	**Turbulence**	ke model	**Special**					
Dimensionality	3d Steady	**A-Array Size**	Mwords	**Grid Dimensions:**	**X**	**Y**	**Z**		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.593 **Standard Deviation** 0.386 **Maximum** 1.75

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.47	1.42	0.499	1.42
Box:	0.919	3.63	0.973	3.27

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.537 **Standard Deviation** 0.604 **Maximum** 3.43

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.255	0.259	0.264	0.0715
Box:	0.468	0.365	0.364	0.59

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.151	0.0184	0.0526

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00532	0.0266
Box:	0.251	0.0911	0.259

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.0046	0.0266
Box:	0.268	0.0845	0.226

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00513	**Sash Leakage Area / Face Area**	0.559
Box Leakage / Hood Flow	0.000088	**Box Leakage Area / Box Surface Area**	0.221

Casename run162ii

Date 4/17/96

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Second hood results

Parametric Variation

2 off Square - layout SM SQ B.4 Hood (each) -783 cfm, Transfer grill 367 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**		no			
Concentration	From hood		**Turbulence**	ke model		**Special**						
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	71	**Y**	35	**Z**	35	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.521	**Standard Deviation**	0.297	**Maximum**	1.58

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.498	1.42	0.53	1.42
Box:	1.06	3	1.1	2.66

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.582	**Standard Deviation**	1.02	**Maximum**	9.11

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.235	0.268	0.446	0.0956
Box:	0.434	0.334	0.808	1.89

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.141	0.0103	0.0394

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00638	0.0319
Box:	0.241	0.0758	0.215

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.0865	0.00552	0.0319
Box:	0.291	0.134	0.456

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00779	**Sash Leakage Area / Face Area**	0.53
Box Leakage / Hood Flow	0.00019	**Box Leakage Area / Box Surface Area**	0.445

Casename run162i

Date 4/17/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), 2 hoods D 3 100 fpm (100%), Supply 1100 cfm (27.3 ACH), Tsup 61°F 16.0°C, heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation

Specialist Devices

Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no	
Concentration	From hood	**Turbulence**	ke model	**Special**					
Dimensionality	3d Steady	**A-Array Size**	Mwords	**Grid Dimensions:**	**X**	**Y**	**Z**		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.563 **Standard Deviation** 0.34 **Maximum** 2.08

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.481	1.42	0.509	1.42
Box:	1.05	2.88	1.06	2.54

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.56 **Standard Deviation** 0.698 **Maximum** 4.65

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.235	0.264	0.357	0.0933
Box:	0.53	0.361	0.668	1.63

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0753	0.00233	0.0104

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00532	0.0266
Box:	0.175	0.0915	0.333

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.0046	0.0266
Box:	0.242	0.151	0.482

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00698	**Sash Leakage Area / Face Area**	0.56
Box Leakage / Hood Flow	0.000138	**Box Leakage Area / Box Surface Area**	0.421

Casename run163ii

Date 4/17/96

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Second hood results

Parametric Variation

2 off Square - layout SM SQ B.4 (part blanked) Hood (each) -783 cfm, Transfer grill 367 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	71	**Y**	35	**Z**	35	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.661	**Standard Deviation**	0.383	**Maximum**	2.06

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.479	1.42	0.523	1.42
Box:	1.06	3.16	1.13	3.03

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.535	**Standard Deviation**	0.667	**Maximum**	7.08

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.236	0.286	0.354	0.0984
Box:	0.549	0.449	0.702	1.14

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.142	0.0163	0.0647

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00638	0.0319
Box:	0.242	0.0996	0.267

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.0865	0.00552	0.0319
Box:	0.271	0.147	0.395

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00589	**Sash Leakage Area / Face Area**	0.518
Box Leakage / Hood Flow	0.000138	**Box Leakage Area / Box Surface Area**	0.435

Casename run163i

Date 4/17/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), 2 hoods D 3 100 fpm (100%), Supply 1100 cfm (27.3 ACH), Tsup 61°F 16.0°C, heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation

Specialist Devices

Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no	
Concentration	From hood	**Turbulence**	ke model	**Special**					
Dimensionality	3d Steady	**A-Array Size**	Mwords	**Grid Dimensions:**	**X**	**Y**	**Z**		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.505 **Standard Deviation** 0.204 **Maximum** 1.29

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.494	1.42	0.499	1.42
Box:	0.948	2.64	0.985	2.48

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.577 **Standard Deviation** 0.782 **Maximum** 11.4

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.252	0.253	0.394	0.0864
Box:	0.375	0.303	0.623	1.04

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0632	0.00275	0.0142

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00532	0.0266
Box:	0.163	0.0591	0.246

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.0046	0.0266
Box:	0.224	0.08	0.314

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00687	**Sash Leakage Area / Face Area**	0.527
Box Leakage / Hood Flow	0.000134	**Box Leakage Area / Box Surface Area**	0.428

Casename run164ii

Date 4/17/96

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Second hood results

Parametric Variation

2 off Square - layout SM SQ B.4 Hood (each) -783 cfm, Transfer grille 66 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**		no			
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	71	**Y**	35	**Z**	35	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.563	**Standard Deviation**	0.319	**Maximum**	1.47

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.478	1.42	0.518	1.42
Box:	0.969	2.83	1.01	2.85

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.668	**Standard Deviation**	1.5	**Maximum**	13.8

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.243	0.279	0.338	0.0773
Box:	0.453	0.352	0.549	0.974

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.105	0.0066	0.0307

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00638	0.0319
Box:	0.205	0.0802	0.272

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.0865	0.00552	0.0319
Box:	0.184	0.103	0.359

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00646	**Sash Leakage Area / Face Area**	0.559
Box Leakage / Hood Flow	0.000098	**Box Leakage Area / Box Surface Area**	0.435

Casename run164i

Date 4/17/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), 2 hoods D 3 100 fpm (100%), supply 1400 cfm (34.7 ACH), Tsup 63°F 17.3°C, heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation

Specialist Devices

Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no	
Concentration	From hood	**Turbulence**	ke model	**Special**					
Dimensionality	3d Steady	**A-Array Size**	Mwords	**Grid Dimensions:**	**X**	**Y**	**Z**		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.618 **Standard Deviation** 0.303 **Maximum** 1.75

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.474	1.42	0.506	1.42
Box:	1.01	2.78	1.05	2.65

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.578 **Standard Deviation** 0.736 **Maximum** 4.5

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.236	0.269	0.328	0.0725
Box:	0.471	0.398	0.577	0.853

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.15	0.0142	0.0501

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00532	0.0266
Box:	0.25	0.0891	0.259

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.0046	0.0266
Box:	0.289	0.111	0.363

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00683	**Sash Leakage Area / Face Area**	0.56
Box Leakage / Hood Flow	0.000101	**Box Leakage Area / Box Surface Area**	0.435

Casename run165ii

Date 4/17/96

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Second hood results

Parametric Variation

2 off Square - layout SM SQ B.4 (part blanked) Hood (each) -783 cfm, Transfer grille 66 cfm, door crack 100 cfm

Specialist Devices	Square diffuser		Fume hood		Ceiling diffuser							
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	71	**Y**	35	**Z**	35	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.91	**Standard Deviation**	0.67	**Maximum**	3.66

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.447	1.42	0.512	1.42
Box:	1.04	3.23	1.23	3.17

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.482	**Standard Deviation**	0.488	**Maximum**	2.96

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.25	0.31	0.24	0.102
Box:	0.737	0.632	0.355	0.868

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.259	0.06	0.129

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00638	0.0319
Box:	0.359	0.165	0.308

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.0865	0.00552	0.0319
Box:	0.353	0.182	0.291

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00383	**Sash Leakage Area / Face Area**	0.563
Box Leakage / Hood Flow	0.000064	**Box Leakage Area / Box Surface Area**	0.359

Casename run165i

Date 4/17/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), 2 hoods D 3 100 fpm (100%), supply 1400 cfm (34.7 ACH), Tsup 63°F 17.3°C, heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation

Specialist Devices

Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no		
Concentration	From hood	**Turbulence**	ke model	**Special**					
Dimensionality	3d Steady	**A-Array Size**	Mwords	**Grid Dimensions:**	**X**	**Y**	**Z**		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.791 **Standard Deviation** 0.587 **Maximum** 3.01

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.464	1.42	0.514	1.42
Box:	0.995	4.02	1.12	3.59

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.643 **Standard Deviation** 1.09 **Maximum** 9.21

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.246	0.264	0.258	0.0825
Box:	0.58	0.495	0.384	0.654

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.262	0.0502	0.0695

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00532	0.0266
Box:	0.362	0.132	0.24

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.0046	0.0266
Box:	0.362	0.13	0.261

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0052	**Sash Leakage Area / Face Area**	0.581
Box Leakage / Hood Flow	0.000093	**Box Leakage Area / Box Surface Area**	0.288

Casename run166ii

Date 4/17/96

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Second hood results

Parametric Variation

2 off Square - layout SM SQ B.4 Hood (each) -783 cfm, Transfer grill 367 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**		no			
Concentration	From hood		**Turbulence**	ke model		**Special**						
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	69	**Y**	35	**Z**	35	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.598	**Standard Deviation**	0.368	**Maximum**	2.08

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.493	1.42	0.53	1.42
Box:	1.07	2.86	1.13	2.62

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.485	**Standard Deviation**	0.483	**Maximum**	2.67

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.235	0.274	0.427	0.0881
Box:	0.489	0.405	0.774	1.76

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.172	0.0158	0.0466

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00638	0.0319
Box:	0.272	0.0895	0.228

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.0865	0.00552	0.0319
Box:	0.318	0.147	0.42

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00752	**Sash Leakage Area / Face Area**	0.493
Box Leakage / Hood Flow	0.000185	**Box Leakage Area / Box Surface Area**	0.381

Casename run166i

Date 4/17/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), 2 hoods D 4 100 fpm (100%), Supply 1100 cfm (27.3 ACH), Tsup 61°F 16.0°C, heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation

Specialist Devices

Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no	
Concentration	From hood	**Turbulence**	ke model	**Special**					
Dimensionality	3d Steady	**A-Array Size**	Mwords	**Grid Dimensions:**	**X**	**Y**	**Z**		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.755 **Standard Deviation** 0.483 **Maximum** 2.66

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.441	1.42	0.498	1.42
Box:	1.02	2.8	1.09	2.83

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.479 **Standard Deviation** 0.481 **Maximum** 2.34

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.228	0.294	0.206	0.0862
Box:	0.706	0.491	0.364	0.783

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.122	0.0197	0.0908

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00638	0.0319
Box:	0.222	0.135	0.369

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.00552	0.0319
Box:	0.247	0.151	0.445

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00429	**Sash Leakage Area / Face Area**	0.593
Box Leakage / Hood Flow	0.000045	**Box Leakage Area / Box Surface Area**	0.374

Casename run167i

Date 4/17/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), 2 hoods D 4 100 fpm (100%), supply 1400 cfm (34.7 ACH), Tsup 63°F 17.3°C, heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off Square - layout SM SQ B.4 Hood (each) -783 cfm, Transfer grille 66 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood		Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5 Mwords	**Grid Dimensions:**	**X**	69	**Y**	35	**Z**	35	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.511	Standard Deviation	0.279	Maximum	1.38

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.476	1.42	0.51	1.42
Box:	0.971	3.06	0.994	2.69

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.758	Standard Deviation	2.02	Maximum	18.7

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.241	0.272	0.331	0.0803
Box:	0.436	0.306	0.547	0.964

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0793	0.0061	0.0404

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00638	0.0319
Box:	0.179	0.0806	0.256

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.00552	0.0319
Box:	0.183	0.105	0.332

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00631	**Sash Leakage Area / Face Area**	0.584
Box Leakage / Hood Flow	0.000090	**Box Leakage Area / Box Surface Area**	0.403

Casename run167ii

Date 4/17/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Second hood results

Parametric Variation

Specialist Devices

Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no		
Concentration	From hood	**Turbulence**	ke model	**Special**					
Dimensionality	3d Steady	**A-Array Size**	Mwords	**Grid Dimensions:**	**X**	**Y**	**Z**		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.696 **Standard Deviation** 0.458 **Maximum** 2.66

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.467	1.42	0.51	1.42
Box:	0.976	2.85	1.09	2.9

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.485 **Standard Deviation** 0.476 **Maximum** 2.26

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.236	0.285	0.289	0.0737
Box:	0.517	0.473	0.55	0.836

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.099	0.00442	0.0211

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00638	0.0319
Box:	0.199	0.0838	0.308

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.00552	0.0319
Box:	0.295	0.117	0.387

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00532	**Sash Leakage Area / Face Area**	0.624
Box Leakage / Hood Flow	0.000073	**Box Leakage Area / Box Surface Area**	0.418

Casename run168i

Date 4/17/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), 2 hoods D 5 100 fpm (100%), supply 1400 cfm (34.7 ACH), Tsup 63°F 17.3°C, heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off Square - layout SM SQ B.4 Hood (each) -783 cfm, Transfer grille 66 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	50	**Y**	36	**Z**	35	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.648	Standard Deviation	0.497	Maximum	2.98

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.47	1.42	0.497	1.42
Box:	0.989	2.86	1.04	2.82

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.531	Standard Deviation	0.573	Maximum	4.26

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.233	0.255	0.339	0.0864
Box:	0.528	0.424	0.526	0.792

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0939	0.00946	0.0558

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00638	0.0319
Box:	0.194	0.0968	0.287

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.00552	0.0319
Box:	0.237	0.121	0.322

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00524	**Sash Leakage Area / Face Area**	0.575
Box Leakage / Hood Flow	0.000079	**Box Leakage Area / Box Surface Area**	0.441

Casename run168ii

Date 4/17/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Second hood results

Parametric Variation

Specialist Devices

Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no		
Concentration	From hood	**Turbulence**	ke model	**Special**					
Dimensionality	3d Steady	**A-Array Size**	Mwords	**Grid Dimensions:**		**X**	**Y**	**Z**	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.668 **Standard Deviation** 0.447 **Maximum** 2.36

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.464	1.42	0.517	1.42
Box:	1.08	3.52	1.12	3.34

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.615 **Standard Deviation** 0.868 **Maximum** 6.93

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.23	0.284	0.311	0.0908
Box:	0.603	0.44	0.552	0.815

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.284	0.0412	0.0727

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00638	0.0319
Box:	0.384	0.132	0.295

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.00552	0.0319
Box:	0.408	0.159	0.389

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00531	**Sash Leakage Area / Face Area**	0.593
Box Leakage / Hood Flow	0.000064	**Box Leakage Area / Box Surface Area**	0.46

Casename run169i

Date 4/17/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), 2 hoods D 6 100 fpm (100%), supply 1400 cfm (34.7 ACH), Tsup 63°F 17.3°C, heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off Square - layout SM SQ B.4 Hood (each) -783 cfm, Transfer grille 66 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood		Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5 Mwords	**Grid Dimensions:**	**X**	67	**Y**	36	**Z**	35	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.578	Standard Deviation	0.262	Maximum	1.43

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.474	1.42	0.497	1.42
Box:	0.897	2.59	0.961	2.6

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.562	Standard Deviation	0.73	Maximum	4.27

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.253	0.269	0.311	0.0743
Box:	0.43	0.364	0.464	0.843

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0711	0.00535	0.0442

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00638	0.0319
Box:	0.171	0.072	0.244

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.00552	0.0319
Box:	0.208	0.0865	0.221

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00523	**Sash Leakage Area / Face Area**	0.575
Box Leakage / Hood Flow	0.000090	**Box Leakage Area / Box Surface Area**	0.397

Casename run169ii

Date 4/17/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Second hood results

Parametric Variation

Specialist Devices

Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no	
Concentration	From hood	**Turbulence**	ke model	**Special**					
Dimensionality	3d Steady	**A-Array Size**	Mwords	**Grid Dimensions:**	**X**	**Y**	**Z**		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.648 **Standard Deviation** 0.291 **Maximum** 1.96

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.468	1.42	0.506	1.42
Box:	1.05	3.22	1.11	3.14

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.511 **Standard Deviation** 0.553 **Maximum** 3.47

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.242	0.293	0.383	0.0955
Box:	0.552	0.402	0.648	0.892

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.303	0.0386	0.0605

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00638	0.0319
Box:	0.403	0.11	0.264

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.00552	0.0319
Box:	0.408	0.138	0.362

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00566	**Sash Leakage Area / Face Area**	0.575
Box Leakage / Hood Flow	0.000066	**Box Leakage Area / Box Surface Area**	0.444

Casename run170i

Date 4/17/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), 2 hoods D 7 100 fpm (100%), supply 1400 cfm (34.7 ACH), Tsup 63°F 17.3°C, heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off Square - layout SM SQ B.4 Hood (each) -783 cfm, Transfer grille 66 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**		no			
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	65	**Y**	36	**Z**	35	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.734	Standard Deviation	0.34	Maximum	2.32

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.473	1.42	0.489	1.42
Box:	0.907	2.55	0.995	2.61

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.554	Standard Deviation	0.586	Maximum	4.69

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.285	0.283	0.351	0.0797
Box:	0.515	0.447	0.492	0.687

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.184	0.0138	0.0495

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00638	0.0319
Box:	0.284	0.0816	0.249

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.00552	0.0319
Box:	0.285	0.0973	0.259

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00497	**Sash Leakage Area / Face Area**	0.566
Box Leakage / Hood Flow	0.000089	**Box Leakage Area / Box Surface Area**	0.345

Casename run170ii

Date 4/17/96

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Second hood results

Parametric Variation

Specialist Devices

Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no		
Concentration	From hood	**Turbulence**	ke model	**Special**					
Dimensionality	3d Steady	**A-Array Size**	Mwords	**Grid Dimensions:**	**X**	**Y**	**Z**		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.631 **Standard Deviation** 0.417 **Maximum** 2.42

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.457	1.42	0.491	1.42
Box:	0.877	2.87	0.997	2.75

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.509 **Standard Deviation** 0.579 **Maximum** 4.86

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.245	0.275	0.244	0.0711
Box:	0.422	0.412	0.405	0.762

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.157	0.0112	0.0321

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00638	0.0319
Box:	0.257	0.0709	0.236

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.0865	0.00552	0.0319
Box:	0.263	0.0736	0.225

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00475	**Sash Leakage Area / Face Area**	0.591
Box Leakage / Hood Flow	0.000056	**Box Leakage Area / Box Surface Area**	0.341

Casename run171i

Date 4/17/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), 2 hoods D 8 100 fpm (100%), supply 1400 cfm (34.7 ACH), Tsup 63°F 17.3°C, heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off Square - layout SM SQ B.4 Hood (each) -783 cfm, Transfer grille 66 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood		Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5 Mwords	**Grid Dimensions:**	**X**	63	**Y**	36	**Z**	35	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.585	Standard Deviation	0.311	Maximum	1.73

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.466	1.42	0.489	1.42
Box:	0.884	2.93	0.933	3.08

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.538	Standard Deviation	0.572	Maximum	2.86

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.256	0.251	0.285	0.0711
Box:	0.434	0.347	0.414	0.587

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0969	0.00473	0.0223

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00638	0.0319
Box:	0.197	0.0719	0.266

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.00552	0.0319
Box:	0.2	0.073	0.269

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00506	**Sash Leakage Area / Face Area**	0.564
Box Leakage / Hood Flow	0.000075	**Box Leakage Area / Box Surface Area**	0.387

Casename run171ii

Date 4/17/96

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Second hood results

Parametric Variation

Specialist Devices

Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no		
Concentration	From hood	**Turbulence**	ke model	**Special**					
Dimensionality	3d Steady	**A-Array Size**	Mwords	**Grid Dimensions:**	**X**	**Y**	**Z**		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.56 **Standard Deviation** 0.363 **Maximum** 1.54

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.453	1.42	0.491	1.42
Box:	0.904	2.76	0.984	2.73

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.531 **Standard Deviation** 0.705 **Maximum** 5.4

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.237	0.276	0.25	0.0751
Box:	0.433	0.378	0.416	0.841

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.151	0.0102	0.0311

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00638	0.0319
Box:	0.251	0.0742	0.249

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.0865	0.00552	0.0319
Box:	0.251	0.0777	0.27

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00521	**Sash Leakage Area / Face Area**	0.585
Box Leakage / Hood Flow	0.000055	**Box Leakage Area / Box Surface Area**	0.445

Casename run172i

Date 4/17/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), 2 hoods D 9 100 fpm (100%), supply 1400 cfm (34.7 ACH), Tsup 63°F 17.3°C, heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off Square - layout SM SQ B.4 Hood (each) -783 cfm, Transfer grille 66 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood		Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5 Mwords	**Grid Dimensions:**	**X**	66	**Y**	36	**Z**	35	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.635 **Standard Deviation** 0.373 **Maximum** 2.11

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.466	1.42	0.474	1.42
Box:	0.91	3.01	0.969	2.98

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.54 **Standard Deviation** 0.555 **Maximum** 3.13

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.264	0.242	0.266	0.0704
Box:	0.468	0.379	0.36	0.643

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.173	0.0154	0.0544

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00507	0.0253
Box:	0.273	0.0903	0.271

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.00438	0.0253
Box:	0.271	0.0882	0.254

Leakage Factor (leakage from a completely contaminated hood)
Sash Leakage / Hood Flow 0.00458 **Sash Leakage Area / Face Area** 0.551
Box Leakage / Hood Flow 0.000058 **Box Leakage Area / Box Surface Area** 0.34

Casename run172ii

Date 4/17/96

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Second hood results

Parametric Variation

Specialist Devices

Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no		
Concentration	From hood	**Turbulence**	ke model	**Special**					
Dimensionality	3d Steady	**A-Array Size**	Mwords	**Grid Dimensions:**	**X**	**Y**	**Z**		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.486 **Standard Deviation** 0.227 **Maximum** 1.28

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.468	1.42	0.478	1.42
Box:	0.9	2.83	0.929	2.69

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.531 **Standard Deviation** 0.524 **Maximum** 2.39

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.259	0.254	0.28	0.0709
Box:	0.366	0.279	0.448	0.617

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0755	0.00495	0.0301

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00507	0.0253
Box:	0.176	0.0664	0.246

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.0865	0.00438	0.0253
Box:	0.172	0.0678	0.212

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00532	**Sash Leakage Area / Face Area**	0.598
Box Leakage / Hood Flow	0.000046	**Box Leakage Area / Box Surface Area**	0.445

Casename run173i

Date 4/17/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), 2 hoods D 10 100 fpm (100%), supply 1400 cfm (34.7 ACH), Tsup 63°F 17.3°C, heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off Square - layout SM SQ B.4 Hood (each) -783 cfm, Transfer grille 66 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser				
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5 Mwords	**Grid Dimensions:**	**X**	62	**Y**	36	**Z**	35	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.623	Standard Deviation	0.376	Maximum	2.66

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.461	1.42	0.489	1.42
Box:	0.938	2.95	0.993	3.14

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.599	Standard Deviation	0.754	Maximum	4.61

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.244	0.258	0.307	0.087
Box:	0.469	0.393	0.463	0.678

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.141	0.0209	0.0501

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00638	0.0319
Box:	0.241	0.0859	0.235

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.00552	0.0319
Box:	0.243	0.0981	0.27

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00477	**Sash Leakage Area / Face Area**	0.529
Box Leakage / Hood Flow	0.000071	**Box Leakage Area / Box Surface Area**	0.389

Casename run173ii

Date 4/17/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Second hood results

Parametric Variation

Specialist Devices

Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no		
Concentration	From hood	**Turbulence**	ke model	**Special**					
Dimensionality	3d Steady	**A-Array Size**	Mwords	**Grid Dimensions:**	**X**	**Y**	**Z**		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.511 **Standard Deviation** 0.236 **Maximum** 1.32

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.485	1.42	0.497	1.42
Box:	0.971	3.05	1.01	2.67

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.685 **Standard Deviation** 1.3 **Maximum** 8.92

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.247	0.257	0.337	0.0838
Box:	0.398	0.318	0.575	0.833

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.112	0.00514	0.0168

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00492	0.0246
Box:	0.212	0.0702	0.283

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.00425	0.0246
Box:	0.243	0.0857	0.326

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00619	**Sash Leakage Area / Face Area**	0.557
Box Leakage / Hood Flow	0.000087	**Box Leakage Area / Box Surface Area**	0.412

Casename run174i

Date 4/17/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), 2 hoods D 11 100 fpm (100%), supply 1400 cfm (34.7 ACH), Tsup 63°F 17.3°C, heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off Square - layout SM SQ B.4 Hood (each) -783 cfm, Transfer grille 66 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood		Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5 Mwords	**Grid Dimensions:**	**X**	63	**Y**	36	**Z**	35	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.733	**Standard Deviation**	0.53	**Maximum**	3.58

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.457	1.42	0.497	1.42
Box:	0.977	2.98	1.07	3.11

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.556	**Standard Deviation**	0.672	**Maximum**	3.77

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.246	0.273	0.286	0.0869
Box:	0.551	0.48	0.445	0.697

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.15	0.0271	0.0702

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00638	0.0319
Box:	0.25	0.105	0.262

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.0865	0.00552	0.0319
Box:	0.248	0.118	0.281

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00436	**Sash Leakage Area / Face Area**	0.551
Box Leakage / Hood Flow	0.000066	**Box Leakage Area / Box Surface Area**	0.375

Casename run174ii

Date 4/17/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Second hood results

Parametric Variation

Specialist Devices

Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no	
Concentration	From hood	**Turbulence**	ke model	**Special**					
Dimensionality	3d Steady	**A-Array Size**	Mwords	**Grid Dimensions:**	**X**	**Y**	**Z**		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.557 **Standard Deviation** 0.299 **Maximum** 1.79

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.474	1.42	0.495	1.42
Box:	0.966	3.15	1	2.72

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.463 **Standard Deviation** 0.491 **Maximum** 3.48

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.237	0.258	0.284	0.0749
Box:	0.458	0.352	0.482	0.733

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.11	0.0066	0.0285

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00604	0.0302
Box:	0.21	0.0823	0.269

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.00522	0.0302
Box:	0.225	0.0876	0.323

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00574	**Sash Leakage Area / Face Area**	0.572
Box Leakage / Hood Flow	0.000062	**Box Leakage Area / Box Surface Area**	0.418

Casename run175i

Date 4/17/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), 2 hoods D 12 100 fpm (100%), supply 1400 cfm (34.7 ACH), Tsup 63°F 17.3°C, heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off Square - layout SM SQ B.4 Hood (each) -783 cfm, Transfer grille 66 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	61	**Y**	36	**Z**	35	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.724	Standard Deviation	0.521	Maximum	3.54

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.456	1.42	0.499	1.42
Box:	0.96	2.83	1.06	2.89

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.554	Standard Deviation	0.614	Maximum	3.4

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.246	0.276	0.279	0.086
Box:	0.557	0.476	0.424	0.692

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.132	0.0207	0.0676

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00638	0.0319
Box:	0.232	0.101	0.282

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.00552	0.0319
Box:	0.228	0.11	0.291

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.0044	**Sash Leakage Area / Face Area**	0.562
Box Leakage / Hood Flow	0.000066	**Box Leakage Area / Box Surface Area**	0.36

Casename run175ii

Date 4/17/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Second hood results

Parametric Variation

Specialist Devices

Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no		
Concentration	From hood	**Turbulence**	ke model	**Special**					
Dimensionality	3d Steady	**A-Array Size**	Mwords	**Grid Dimensions:**	**X**	**Y**	**Z**		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.491 **Standard Deviation** 0.257 **Maximum** 1.31

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.453	1.42	0.481	1.42
Box:	0.941	2.82	0.957	2.43

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.455 **Standard Deviation** 0.456 **Maximum** 1.88

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.226	0.25	0.263	0.0754
Box:	0.459	0.333	0.458	0.754

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0903	0.00664	0.0332

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00638	0.0319
Box:	0.19	0.0773	0.284

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.00552	0.0319
Box:	0.188	0.0816	0.347

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00532	**Sash Leakage Area / Face Area**	0.611
Box Leakage / Hood Flow	0.000048	**Box Leakage Area / Box Surface Area**	0.418

Casename run176i

Date 4/17/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), 2 hoods D 13 100 fpm (100%), supply 1400 cfm (34.7 ACH), Tsup 63°F 17.3°C, heat load 8 W/ft²(equip 5.7 W/ft²)

Parametric Variation
2 off Square - layout SM SQ B.4 Hood (each) -783 cfm, Transfer grille 66 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**		no			
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	59	**Y**	36	**Z**	35	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.562	**Standard Deviation**	0.393	**Maximum**	1.91

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.442	1.42	0.485	1.42
Box:	0.928	2.83	0.963	3.03

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.562	**Standard Deviation**	0.764	**Maximum**	8.82

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.234	0.271	0.205	0.0787
Box:	0.517	0.4	0.332	0.714

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0498	0.000778	0.0127

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00432	0.0216
Box:	0.15	0.0912	0.303

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.0865	0.00374	0.0216
Box:	0.171	0.0963	0.363

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.005	**Sash Leakage Area / Face Area**	0.606
Box Leakage / Hood Flow	0.000021	**Box Leakage Area / Box Surface Area**	0.455

Casename run176ii

Date 4/17/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Second hood results

Parametric Variation

Specialist Devices

Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no	
Concentration	From hood	**Turbulence**	ke model	**Special**					
Dimensionality	3d Steady	**A-Array Size**	Mwords	**Grid Dimensions:**	**X**	**Y**	**Z**		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.453 **Standard Deviation** 0.244 **Maximum** 1.27

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.469	1.42	0.504	1.42
Box:	0.943	3.47	0.951	3.04

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.424 **Standard Deviation** 0.466 **Maximum** 2.21

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.258	0.285	0.295	0.0819
Box:	0.422	0.315	0.453	0.641

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0	0	0

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00515	0.0257
Box:	0.1	0.0717	0.286

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.00445	0.0257
Box:	0.132	0.08	0.343

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00565	**Sash Leakage Area / Face Area**	0.568
Box Leakage / Hood Flow	0.000042	**Box Leakage Area / Box Surface Area**	0.404

Casename run177i

Date 4/17/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), 2 hoods D 14 100 fpm (100%), supply 1400 cfm (34.7 ACH), Tsup 63°F 17.3°C, heat load 8 W/ft²(equip 5.7 W/ft²)

Parametric Variation
2 off Square - layout SM SQ B.4 Hood (each) -783 cfm, Transfer grille 66 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**		no			
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	59	**Y**	41	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.551	**Standard Deviation**	0.388	**Maximum**	2.18

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.452	1.42	0.496	1.42
Box:	0.897	2.62	0.979	2.79

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.602	**Standard Deviation**	1.07	**Maximum**	12.6

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.234	0.273	0.255	0.07
Box:	0.46	0.39	0.458	0.698

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0331	0.00167	0.0204

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00638	0.0319
Box:	0.133	0.0703	0.258

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.0865	0.00552	0.0319
Box:	0.147	0.0909	0.33

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00543	**Sash Leakage Area / Face Area**	0.599
Box Leakage / Hood Flow	0.000040	**Box Leakage Area / Box Surface Area**	0.423

Casename run177ii

Date 4/17/96

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Second hood results

Parametric Variation

Specialist Devices

Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no		
Concentration	From hood	**Turbulence**	ke model	**Special**					
Dimensionality	3d Steady	**A-Array Size**	Mwords	**Grid Dimensions:**	**X**	**Y**	**Z**		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.472 **Standard Deviation** 0.268 **Maximum** 1.37

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.471	1.42	0.505	1.42
Box:	1.02	3.46	0.979	3.09

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.425 **Standard Deviation** 0.477 **Maximum** 2.09

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.258	0.282	0.297	0.0825
Box:	0.468	0.295	0.438	0.705

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0	0	0

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00515	0.0257
Box:	0.1	0.102	0.33

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.0865	0.00445	0.0257
Box:	0.118	0.103	0.382

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00566	**Sash Leakage Area / Face Area**	0.567
Box Leakage / Hood Flow	0.000050	**Box Leakage Area / Box Surface Area**	0.475

Casename run178i

Date 4/17/96

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), 2 hoods D 15 100 fpm (100%), supply 1400 cfm (34.7 ACH), Tsup 63°F 17.3°C, heat load 8 W/ft²(equip 5.7 W/ft²)

Parametric Variation
2 off Square - layout SM SQ B.4 Hood (each) -783 cfm, Transfer grille 66 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**		no			
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	60	**Y**	41	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.615	**Standard Deviation**	0.408	**Maximum**	2.25

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.46	1.42	0.496	1.42
Box:	0.941	3	0.981	2.78

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.485	**Standard Deviation**	0.567	**Maximum**	3.85

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.245	0.286	0.321	0.103
Box:	0.524	0.408	0.513	0.938

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.099	0.00639	0.0272

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.1	0.00638	0.0319
Box:	0.199	0.0796	0.252

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0.0865	0.00552	0.0319
Box:	0.211	0.11	0.308

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00487	**Sash Leakage Area / Face Area**	0.57
Box Leakage / Hood Flow	0.000072	**Box Leakage Area / Box Surface Area**	0.425

Casename run178ii

Date 4/17/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Second hood results

Parametric Variation

Specialist Devices

Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no		
Concentration	From hood	**Turbulence**	ke model	**Special**					
Dimensionality	3d Steady	**A-Array Size**	Mwords	**Grid Dimensions:**	**X**	**Y**	**Z**		

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.571 **Standard Deviation** 0.26 **Maximum** 1.48

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.495	1.42	0.521	1.42
Box:	0.957	2.88	1.01	2.54

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.577 **Standard Deviation** 1.07 **Maximum** 7.16

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.279	0.297	0.348	0.0733
Box:	0.447	0.353	0.53	0.654

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.16	0.0135	0.0478

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.00515	0.0257
Box:	0.26	0.0865	0.284

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.00445	0.0257
Box:	0.276	0.0942	0.251

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00613	**Sash Leakage Area / Face Area**	0.572
Box Leakage / Hood Flow	0.000084	**Box Leakage Area / Box Surface Area**	0.359

Casename run179

Date 4/18/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft², equip 5.7 W/ft²)

Parametric Variation
1 off square - layout SM SQ B.1, hood posn 2 Hood -783 cfm, trans grille 319 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	49	**Y**	29	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.453	Standard Deviation	0.367	Maximum	1.85

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.275	0.38	0.271	0.375
Box:	0.689	2.03	0.705	1.85

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.639	Standard Deviation	0.397	Maximum	1.51

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0753	0.0534	0.0865	0.0344
Box:	0.388	0.23	0.143	0.422

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.139	0.00639	0.0197

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.239	0.0548	0.203

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.226	0.0467	0.178

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00243	**Sash Leakage Area / Face Area**	0.565
Box Leakage / Hood Flow	0.000035	**Box Leakage Area / Box Surface Area**	0.528

Casename run180

Date 4/18/96

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%) Supply 365 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
1 off radial layout SM TAD A.2a, hood position 2 Hood -783 cfm, Trans grille 319 cfm, door crack 100 cfm

Specialist Devices	TAD			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	46	**Y**	29	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.395 **Standard Deviation** 0.325 **Maximum** 1.56

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.32	0.431	0.318	0.394
Box:	0.8	2.18	0.799	1.95

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.636 **Standard Deviation** 0.472 **Maximum** 1.94

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.054	0.0396	0.163	0.0351
Box:	0.408	0.204	0.315	0.957

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.167	0.0104	0.036

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.267	0.0626	0.203

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.275	0.0757	0.245

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00341	**Sash Leakage Area / Face Area**	0.571
Box Leakage / Hood Flow	0.000053	**Box Leakage Area / Box Surface Area**	0.438

Casename run181

Date 4/18/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm, (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
1 off radial layout SM TAD A.1a, hood posn 2 Hood -783 cfm, Trans grille 319 cfm, door crack 100 cfm

Specialist Devices	TAD			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**		no				
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	47	**Y**	29	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.464	Standard Deviation	0.391	Maximum	1.87

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.288	0.386	0.282	0.391
Box:	0.723	2.14	0.743	1.84

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.639	Standard Deviation	0.387	Maximum	1.37

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0769	0.0561	0.0698	0.0234
Box:	0.402	0.258	0.164	0.474

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.164	0.00873	0.0306

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.264	0.0584	0.189

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.251	0.0549	0.178

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00256	**Sash Leakage Area / Face Area**	0.565
Box Leakage / Hood Flow	0.000051	**Box Leakage Area / Box Surface Area**	0.508

Casename run182

Date 4/18/96

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1 ACH), Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off perf hori - layout SM PERF A.1 hood posn 2 Hood -783 cfm, Trans grille 319 cfm, door crack 100 cfm

Specialist Devices	Perforated diff		Fume hood		Ceiling diffuser						
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	52	**Y**	29	**Z**	33

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.566 **Standard Deviation** 0.345 **Maximum** 1.98

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.289	0.434	0.284	0.353
Box:	0.773	2.14	0.821	1.71

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.641 **Standard Deviation** 0.385 **Maximum** 1.31

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.079	0.073	0.0839	0.0381
Box:	0.477	0.325	0.217	1.06

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.164	0.0193	0.0494

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.264	0.0812	0.206

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.258	0.0827	0.216

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00237	**Sash Leakage Area / Face Area**	0.486
Box Leakage / Hood Flow	0.000057	**Box Leakage Area / Box Surface Area**	0.479

Casename run183

Date 4/18/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 365 cfm (9.1) ACH, Tsup 55°F, 12.8°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off square - layout SM SQ A.1, hood posn 2 Transfer grille over main door, Hood -783 cfm, trans grille 319 cfm, door crack 100 cfm

Specialist Devices	Square diffuser		Fume hood		Ceiling diffuser							
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	55	**Y**	33	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.51	Standard Deviation	0.341	Maximum	1.79

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.3	0.434	0.301	0.392
Box:	0.772	2.14	0.785	1.94

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.644	Standard Deviation	0.446	Maximum	2.18

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0836	0.105	0.0903	0.0495
Box:	0.457	0.294	0.213	0.807

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.166	0.0162	0.0503

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.266	0.0784	0.229

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.247	0.0739	0.21

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.003	**Sash Leakage Area / Face Area**	0.546
Box Leakage / Hood Flow	0.000044	**Box Leakage Area / Box Surface Area**	0.382

Casename run184

Date 4/18/96

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 684 cfm (17 ACH), Tsup 63°F 17.2°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off 12" square - layout SM SQ A.1 hood posn 2 Hood -783 cfm, Transfer grille SHUT, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	3	Mwords	**Grid Dimensions:**	**X**	51	**Y**	29	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.501 **Standard Deviation** 0.317 **Maximum** 1.71

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.3	0.393	0.3	0.355
Box:	0.758	2.26	0.807	2.24

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.651 **Standard Deviation** 0.445 **Maximum** 1.73

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0653	0.0995	0.079	0.0402
Box:	0.435	0.288	0.24	1.13

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0589	0.00365	0.0295

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.159	0.0628	0.214

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.177	0.07	0.236

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00292	**Sash Leakage Area / Face Area**	0.566
Box Leakage / Hood Flow	0.000052	**Box Leakage Area / Box Surface Area**	0.502

Casename run185

Date 4/18/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 684 cfm (17 ACH), Tsup 63°F 17.2°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
1 off 24" square - layout SM SQ B.1, hood posn 2 Hood -783 cfm, Transfer grille SHUT, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood		Ceiling diffuser						
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	3	Mwords	**Grid Dimensions:**	**X**	49	**Y**	29	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.375	Standard Deviation	0.264	Maximum	1.48

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.285	0.388	0.276	0.351
Box:	0.638	1.57	0.637	1.63

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.662	Standard Deviation	0.408	Maximum	1.37

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0489	0.0309	0.0516	0.0165
Box:	0.268	0.139	0.107	0.366

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0	0	0

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0853	0.0272	0.191

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0596	0.0132	0.0993

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00264	**Sash Leakage Area / Face Area**	0.623
Box Leakage / Hood Flow	0.000042	**Box Leakage Area / Box Surface Area**	0.609

Casename run186

Date 4/18/96

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 684 cfm (17 ACH), Tsup 63°F 17.2°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
1 off Radial - layout SM TAD A.3, hood posn 2 Hood -783 cfm, Transfer grille SHUT, door crack 100 cfm

Specialist Devices	TAD			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	3	Mwords	**Grid Dimensions:**	**X**	45	**Y**	27	**Z**	34	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.446 **Standard Deviation** 0.281 **Maximum** 1.31

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.305	0.401	0.3	0.36
Box:	0.717	1.98	0.718	1.93

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.653 **Standard Deviation** 0.444 **Maximum** 1.71

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0493	0.0188	0.101	0.0332
Box:	0.346	0.206	0.19	1.03

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.022	0.000656	0.006

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.122	0.0465	0.186

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.106	0.0384	0.177

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00323	**Sash Leakage Area / Face Area**	0.554
Box Leakage / Hood Flow	0.000073	**Box Leakage Area / Box Surface Area**	0.602

Casename run188

Date 4/18/96

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 684 cfm (17 ACH), Tsup 63°F 17.2°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off Perforated - layout SM PERF A.1, hood posn 2 Hood -783 cfm, Transfer grille SHUT, door crack 100 cfm

Specialist Devices	Perforated diff			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None		**Comfort Temp**		no			
Concentration	From hood		**Turbulence**	ke model		**Special**						
Dimensionality	3d Steady	**A-Array Size**	3	Mwords	**Grid Dimensions:**	**X**	50	**Y**	29	**Z**	33	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.5 **Standard Deviation** 0.331 **Maximum** 1.83

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	**Max (Velocity)**	**Mean (Speed)**	**Max (Speed)**
Sash:	0.315	0.384	0.312	0.343
Box:	0.774	1.98	0.825	1.95

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.643 **Standard Deviation** 0.421 **Maximum** 1.48

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	**Speed**	**Turbulent Intensity**	**Dilution**
Sash:	0.0606	0.0919	0.137	0.0446
Box:	0.441	0.291	0.31	1.79

Outflows (m/s) (flow away from the sash opening)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.0866	0.00423	0.0309

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.187	0.0603	0.211

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	**Total -ve flow**	**Proportion of Area with -ve flow**
Sash:	0	0	0
Box:	0.174	0.0717	0.233

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00336	**Sash Leakage Area / Face Area**	0.494
Box Leakage / Hood Flow	0.000080	**Box Leakage Area / Box Surface Area**	0.575

Casename run187

Date 4/18/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 684 cfm (17 ACH), Tsup 63°F 17.2°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
1 off square-layout SM SQ B.5, between B.1 & B.3 Hood -783 cfm transfer grille SHUT, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	3	Mwords	**Grid Dimensions:**	**X**	41	**Y**	31	**Z**	35	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.385	Standard Deviation	0.329	Maximum	1.83

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.347	0.403	0.354	0.402
Box:	0.792	1.87	0.867	2

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.64	Standard Deviation	0.442	Maximum	1.86

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0503	0.0646	0.273	0.108
Box:	0.234	0.238	0.474	6.98

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0773	0.00347	0.0134

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.177	0.0269	0.114

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.234	0.053	0.207

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00439	**Sash Leakage Area / Face Area**	0.507
Box Leakage / Hood Flow	0.000178	**Box Leakage Area / Box Surface Area**	0.481

Casename run189

Date 4/18/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 684 cfm (17 ACH), Tsup 63°F 17.2°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
1 off square - layout SM SQ B.3a, no blanking Hood -783 cfm transfer grille SHUT, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood		Ceiling diffuser						
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	3	Mwords	**Grid Dimensions:**	**X**	39	**Y**	31	**Z**	35	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.542	Standard Deviation	0.416	Maximum	2.09

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.337	0.404	0.349	0.407
Box:	0.88	2.02	0.932	1.92

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.623	Standard Deviation	0.435	Maximum	1.51

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0571	0.102	0.253	0.0941
Box:	0.484	0.336	0.44	9.36

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0694	0.00776	0.0472

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.169	0.0676	0.216

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.217	0.103	0.273

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00414	**Sash Leakage Area / Face Area**	0.495
Box Leakage / Hood Flow	0.000276	**Box Leakage Area / Box Surface Area**	0.393

Casename run190

Date 4/18/96

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 684 cfm (17 ACH), Tsup 63°F 17.2°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
1 off square - layout SM SQ B.3a, no blanking Bulkhead fitted to hood, hood -783 cfm transfer grille SHUT, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood		Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no				
Concentration	From hood	**Turbulence**	ke model	**Special**							
Dimensionality	3d Steady	**A-Array Size**	3	Mwords	**Grid Dimensions:**	**X**	39	**Y**	31	**Z**	35

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.606 **Standard Deviation** 0.471 **Maximum** 2.33

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.33	0.462	0.377	0.538
Box:	0.924	3.28	0.992	3.13

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.599 **Standard Deviation** 0.443 **Maximum** 1.65

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0678	0.166	0.189	0.0862
Box:	0.554	0.407	0.367	5.22

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0579	0.0127	0.0744

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.158	0.0874	0.243

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.19	0.119	0.271

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00355	**Sash Leakage Area / Face Area**	0.518
Box Leakage / Hood Flow	0.00016	**Box Leakage Area / Box Surface Area**	0.293

Casename run191

Date 4/18/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 684 cfm (17 ACH), Tsup 63°F 17.2°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
1 off square SM SQ B.3c Bulkhead, no blanking, diff moved 1 ft away from hood, hood -783 cfm transfer grille SHUT, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood		Ceiling diffuser						
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	3	Mwords	**Grid Dimensions:**	**X**	39	**Y**	30	**Z**	35	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.595 **Standard Deviation** 0.455 **Maximum** 2.46

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.332	0.451	0.387	0.551
Box:	0.953	3.39	0.986	3.23

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.609 **Standard Deviation** 0.475 **Maximum** 1.8

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0633	0.177	0.189	0.093
Box:	0.616	0.392	0.36	5.72

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0842	0.0157	0.0671

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.184	0.0982	0.252

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.233	0.127	0.284

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00346	**Sash Leakage Area / Face Area**	0.537
Box Leakage / Hood Flow	0.000174	**Box Leakage Area / Box Surface Area**	0.325

Casename run192

Date 4/18/96

Description

Model	**Flow**	**Application Types**	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 684 cfm (17 ACH), Tsup 63°F 17.2°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
1 off square SM SQ B.3d Bulkhead, no blanking, diff moved 1 ft nearer to hood, hood -783 cfm transfer grille SHUT, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	3	Mwords	**Grid Dimensions:**	**X**	39	**Y**	30	**Z**	35	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)
Mean 0.527 **Standard Deviation** 0.438 **Maximum** 1.82

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.32	0.466	0.355	0.515
Box:	0.838	3.17	0.904	3.05

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')
Mean 0.631 **Standard Deviation** 0.446 **Maximum** 1.39

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.0749	0.153	0.168	0.0778
Box:	0.468	0.352	0.314	2.57

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.0563	0.00494	0.038

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.156	0.0661	0.21

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.209	0.0843	0.261

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.00304	**Sash Leakage Area / Face Area**	0.531
Box Leakage / Hood Flow	0.000084	**Box Leakage Area / Box Surface Area**	0.303

Casename run191

Date 4/18/96

Description

Model	Flow	Application Types	
Internal	Forced	Laboratory	Fume hood

Case Description
Small laboratory (22 x 11), hood 100 fpm (100%), Supply 684 cfm (17 ACH), Tsup 63°F 17.2°C, total heat load 8 W/ft² (equip 5.7 W/ft²)

Parametric Variation
2 off Square - layout SM SQ A.1 Hood -783 cfm, Transfer grille 66 cfm, door crack 100 cfm

Specialist Devices	Square diffuser			Fume hood			Ceiling diffuser					
Thermal	yes	**Buoyancy**	Boussinesq	**Radiation**	None	**Comfort Temp**	no					
Concentration	From hood	**Turbulence**	ke model	**Special**								
Dimensionality	3d Steady	**A-Array Size**	5	Mwords	**Grid Dimensions:**	**X**	63	**Y**	36	**Z**	35	

Analysis Results

Dalle Valle Ratio (velocity comparison with a perfect exhaust)

Mean	0.5332	Standard Deviation	0.2836	Maximum	1.3526

Performance Index (PI) (based on velocity and turbulence)

	Mean (Velocity)	Max (Velocity)	Mean (Speed)	Max (Speed)
Sash:	0.457	1.4247	0.4777	1.4247
Box:	0.8737	2.9017	0.9125	3.1421

Time (s) (for air to reach the sash opening from outside the 13" deep working zone 'box')

Mean	0.5705	Standard Deviation	0.7942	Maximum	5.3108

Mean Difference Ratio (compared with hood in isolation)

	Perpendicular Velocity	Speed	Turbulent Intensity	Dilution
Sash:	0.2393	0.2457	0.2888	0.0836
Box:	0.4176	0.3212	0.3787	0.6257

Outflows (m/s) (flow away from the sash opening)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0	0	0
Box:	0.118	0.0081	0.0355

Outflows Enhanced by 20% of Face Velocity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.1	0.0064	0.0319
Box:	0.218	0.0674	0.213

Outflows Enhanced by Local Turbulent Intensity (m/s)

	Max -ve	Total -ve flow	Proportion of Area with -ve flow
Sash:	0.0865	0.0055	0.0319
Box:	0.2207	0.0682	0.2052

Leakage Factor (leakage from a completely contaminated hood)

Sash Leakage / Hood Flow	0.004707	**Sash Leakage Area / Face Area**	0.5557
Box Leakage / Hood Flow	0.000055	**Box Leakage Area / Box Surface Area**	0.3989